Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 66 NEW YORK, SATURDAY, AUGUST 28, 1915 No. 9

The Non-Electrical Distributer

FEW in the industry appreciate the growing influence of the non-electrical distributer as a factor in the development of the market for electrical appliances. The hardware man, the druggist and the department store are steadily becoming more interested in the sale of electric flatirons, toasters, percolators, washing machines and vacuum cleaners. What is the electrical merchant going to do about it? The popular demand for these electric household devices has grown to a proportion that has attracted the attention of the non-electrical merchant. He has seen the opportunity and taken steps to make it his own, all traditions to the contrary notwithstanding. If the non-electrical distributer gets the business, it will be because he proves himself a better merchant. It does not seem reasonable to assume that he should be permitted to get the business if the methods of the enterprising electrical dealer are made the methods of all electrical dealers.

The Price of Labor

A SERIOUS condition faces the employer of labor. The great war has unbalanced the economic scales of the world, and just now money is flowing into the United States for the immediate benefit of those industries directly affected. Labor naturally expects its share of this temporarily large return. It not only expects it but is getting it, with the result that new wage standards are now being set which are in fact at least artificial and certainly are not warranted for business as a whole. There is a distinct element of insecurity in American prosperity if labor is permanently and everywhere to look upon estimated war profits of a few concerns as a criterion for a general increase in the wage scale. If the increase in wages were along the lines of distinct profit-sharing of this temporary increase in income, the aggressive tactics of labor would seem sounder economically. It is not a secret that the costs of doing business which are reflected in higher costs of living have in general cut the margin of profit in business. Isolated examples of extraordinary profits are by no means typical of present-day conditions. Investigations of different organizations refute a quite generally stated belief that capital absorbs four-fifths of the annual output of modern industry. A committee of the National Civic Federation, for example, has recently concluded that in general, after miscellaneous expenses and the cost of materials and supplies are deducted, the net earnings of industry are divided two-thirds for wages and one-third for interest, profits and upkeep. In other words, capital receives one-half as much as labor, instead of four times as much. To determine whether this is a fair general average is not so important as that the readjustment of the wage scale now taking place is altogether unfair to industry as a whole. It is conceivable that artificial readjustments of this nature will lead to a labor war, unprofitable and wasteful to both labor and capital.

Too Many Dishes

A CUP of coffee at a Childs' or a Kohlsaat's restaurant costs five cents. At a high-priced eating place the charge on the bill varies from twenty-five to fifty cents. The difference is mostly dishes. True, there may be personal satisfaction in drinking from china rather than crockery. A man may be willing to pay for soft carpets, silver creamers and coffeepots, but included in the charge for service there is undoubtedly stored up a return on an amount of capital that might be released to more profitable use. Business is full of examples of this sort, and the electrical industry is not free from the universal extra cost of service. The destruction of capital which comes from a great war will automatically check this tendency to tie up capital in unnecessary service. Having less capital with which to do business, we have already tightened up the machinery and stopped many wasteful practices. Industry as a whole must be content with plainer fare and fewer "dishes." And just as such plainer fare means sturdier men so the pruning of extra expenses in various overhead charges means healthier business. Let us analyze our methods and readjust our use of capital. Fixed expenses are necessary. Service without frills is worth having and paying for. But let us put our capital to work rather than put it to rest.

Who Should Do the Wiring?

A SURPRISING variety of opinion exists on the subject of whether or not the central station can be justified in maintaining a wiring department. The fact that so many enterprising central stations still continue to wire houses in competition with the local contractors indicates that there is still much to be said to support the practice. They are doing this work only because they consider it profitable and necessary; yet the practice has been abandoned by many as fundamentally wrong. Apparently after much discussion there remain two opinions on the basic issue. What a business becomes in a community depends more often

on the initiative and enterprise of the individual men than on fundamental principles. In a discussion so important an attempt should be made to get at the principles, so that both groups of individuals will at least have a common starting place. Experience can be the only guide—experience of contractor as well as of central station—and the ELECTRICAL WORLD has been gathering the evidence for some time past preparatory to a frank discussion of the issue. Its editors invite comment on this question.

Day Service at Summer Resorts

In small communities largely populated by summer visitors and remote from any central station or transmission system giving continuous service the problem of furnishing energy during the daytime is one of much difficulty. The bulk of the load is provided by the lighting demand in many such places, the industries being few aside from fishing, farming and caring for vacationists. The result is that in such cases the lines are dead from dawn to dusk, and the use of small motors and of electric heating appliances is meager indeed. That any demand whatever should have arisen under these circumstances for electric flatirons, fan motors, etc., is surprising, and the development which has sometimes taken place in face of this obstacle of limited hours of use is simply amazing. When people are eager to use electrical conveniences on a system having no day service of any kind, it is certainly an incentive to the management of the central station to study constantly the possibility of running a machine of small output throughout the day.

To supply continuous service in these small places a diversified load is commercially essential, or else the operation of the generating plant must in some way be combined with other utilities or industrial pursuits in order to reduce the cost of attendance. A chain of seaside or country resorts within reach of a single plant and perhaps combining trolley service with other advantages presents less difficulty than the single community which is too far removed from others to warrant pooling its electrical resources. The demand is sure to be more diversified throughout a considerable area, and variations in topographical conditions, amusements and local interests tend to create a market for small motor applications which may be lacking in a single resort town.

In the latter case it is perhaps of chief importance to try to combine the central-station operations with long-hour pumping where the municipal water supply is thus handled. Local pride is strong, and sometimes the installation of a first-class water system with its potentialities in the way of fire protection can be put through to the advantage of all interests concerned. Pure water in ample quantity is one of the main essentials of a thriving resort to-day, and with a fair-sized winter population outlays for such a supply are often justified on a scale which would not be supportable in a community practically deserted except in the summer.

The Commission and the Utility

A recent address before the Ohio Electric Light Association puts in a clear light the principle of mutual obligation as between the public commission and the utilities which it is designed to regulate. At the outset commissions seem to have been intended chiefly to maintain the interests of the public against those of corporations doing a public business, and commissions, therefore, were looked at somewhat askance by those who had their money invested in railways, lighting companies and similar enterprises. But in recent times the relations between the public and those who thus serve it have undergone a change for the better that is one of the strongest signs of improvement in civic affairs. These relations seemed at one time to be mutually predatory, but such a condition of affairs has practically ceased to exist. The time has now come when the managers of public utilities recognize fully their obligations as well as their opportunities and are striving to build up their respective enterprises on a permanent and sound basis, with a keen eye to the future and the realization that good service means increased profits. Many a city council would be agreeably surprised if it could listen to the deliberations of its utility managers or to their confidential conferences with their engineers. Instead of plotting to charge all the traffic would bear, they would find these gentlemen scheming improvements which look to better service and to lower prices, and would realize that they are ready to meet the public more than half way in working for their mutual good.

To do the commissions justice, they are, from their close understanding of company affairs, nearer to grasping the situation in its entirety than is the community at large. They stand ready, as is their duty, to see that the public gets fair treatment and fair prices, but they are also ready to hear the other side and to give public utilities an opportunity for reasonable and stable profits. In fact, they generally try to play the game fairly, although now and then swayed by popular clamor in a way that, temporarily at least, bears hard on the investor. Yet on numerous occasions they have seen that fair play requires regulation also of public rights and privileges. When, for instance, an electric railway has found itself in a tight place owing to its too optimistic view of public support, commissions have not hesitated to permit such reasonable increase of its rates as would recoup it for its honest efforts in the public behalf. In fact, when a railway comes with clean hands to ask for equity it stands an exceedingly good chance of getting it. In the lighting field we are happy to say business has generally so prospered that there has been no acute need of calling upon the commissions for help, yet we do not doubt that if it were necessary to do so, and a clear showing of right could be made, the commissions would respond to the appeal in a friendly spirit. In many matters of minor detail, to use a homely simile, the commissions' bark has proved worse than their bite. In theory they keep up a supervision of service and of accounting which, if they were dis-

posed to be unfair, could be made extremely burdensome; yet as a matter of fact they generally deal in a very friendly spirit with any company which really is trying to do the right thing and to meet them half way. Moreover, public utilities find great advantage in dealing with responsible representatives of the public like a commission rather than with quarrelsome and litigious individuals who raise unreasonable protest for political or personal reasons and try to stir up trouble in the community. Such there are, as many a central-station man knows to his discomfort. Before the days of commissions these trouble makers had a free hand to stir up the press and the local authorities to any extent of which they were capable. Now their efforts at mischief are limited by the fact that they have a responsible commission before which their grievances may be laid and dealt with according to their deserts, and in a large majority of cases the commissions have passed out even-handed justice. Perhaps the best sign of their honorable intent is the fact that a good many decisions have left both parties pacified, even if not fully convinced, which is a pretty sure sign that the outcome has not been radically unfair.

The Boiler-Room Bonus System

The maintenance of continuously efficient combustion in the furnace of a steam boiler demands constant watchfulness and attention on the part of the fireman. If the load is uniform, as in a manufacturing plant, the regulation of the air supply and the draft becomes a simple matter; but if the load is variable, the air supply and the position of the damper must be changed frequently, to correspond to the demands for steam. Moreover, when boilers are fired by hand, whether the load is variable or not, the amount of air admitted to the furnace should be increased at the moment of firing green coal. To make these changes in the conditions of combustion as often as they become necessary, the fireman must pay closer attention to his work, and this fact offers a probable explanation of why so many firemen shirk their responsibilities. They feel that the extra work entailed by the repeated regulation of air and draft is something for which they get no credit and for which they are not paid, and the natural tendency is to neglect it. In such a case the adoption of a bonus system may offer a solution of the difficulty. If the fireman is to receive a share of the value of the fuel saved by his efforts to maintain efficient combustion, however, two important points must be kept in mind. First of all, the percentage offered must be large enough to make him feel like working to obtain it, and, second, a continuous record of the combustion and the evaporation must be kept, to form the basis on which to compute the bonus. It is folly to rely on intermittent analyses of the flue gases to determine the average efficiency of furnace regulation; for a clever fireman can so manipulate his dampers and ashpit doors, during the making of tests, as to show a high percentage of carbon dioxide, and let the conditions fall into extreme inefficiency during the periods between tests. If he is able to make favorable records at such particular times, he is able to do so continuously and a bonus system is often adopted to furnish the necessary incentive. A bonus system, however, is wrong fundamentally and is not to be commended. Conscientious work on the part of a fireman should be recognized by promotion or increased wages.

Buying or Making Power

Whether it will pay to make his own power or to buy energy from a central station must be determined by the manufacturer or other user on the basis of his financial and operating conditions. One consideration with an important bearing on the final decision that is sometimes overlooked is the relation of capital investment to the cost of power. The determining factor involves not only the engineering element of interest on investment but the excutive element of whether investment in plant is the most profitable use to which that amount of capital can be put. The fixed investment for power-generating equipment in some cases can be released to more profitable use in buying materials or meeting the payrolls or buying productive machinery.

In deciding on the course of power in any case, then, the proper attitude of engineer and management can be summed up in one question which they may put to themselves and properly answer on the basis of manufacturing economy: Is purchased power from a central station more economical than home-made power on the basis of these two factors: first, will it enable us to secure the power we need at the smallest cost per unit output, and, second, will the capital called for be the least necessary and permit the greatest return? It is evident that the answer to this twofold question must take into consideration the fact that money invested in private-plant machinery is a part of the total equipment in the same sense as any other machinery directly used for manufacturing the particular product handled. The amount to be invested in power must further be considered in its relation to the total investment consistent with effective and economical operation. If the total amount of capital is limited, the relative amount which a suitable power plant would require may, in some cases, be better invested in or be available for productive operations.

The plant manager must face these considerations and answer them in conjunction with the engineering facts involved. The most logical attitude he can assume when considering central-station service is to realize that the central station is a specialist in the production of power just as naturally as he assumes to be a specialist in the production of the product he sells. Then he may compare cost against cost. Next, consider the capital invested as explained. His final decision as to whether to buy or make power will have been arrived at on a safe basis, and there is little room left for arguing for one source of electrical energy as against the other.

ON Aug. 18 Youngstown, Ohio, inaugurated a new street-lighting system consisting of 257 20-amp. and 288 6.6-amp. series, gas-filled tungsten lamps mounted on ornamental standards. The larger lamps are used in the down-town section known as "The Diamond." Series transformers are mounted in the concrete base of each lighting standard, the standards being connected by nearly five miles of underground circuits and being spaced from 50 ft. to 75 ft. apart, opposed, on down-town streets. The light center of the lamp is 14.5 ft. above the curb. The installation is one of the largest of its kind in existence.

The number of people gathered for the formal ceremonies of placing the new lighting system in operation was the largest ever seen in the city. Delegates came from many neighboring towns and cities, and a great proportion of the inhabitants of the city itself were out to take part in the demonstration. Following a parade of decorated automobiles, President Stevens of the Mahoning & Shenango Railway & Light Company turned over the system to the Mayor of the city, who responded in an appropriate speech. As soon as he ceased speaking the lamps in the buildings and signs about the square were extinguished and the new standards were lighted.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Flood and Hurricane Damage Texas Properties

The tropical hurricane which swept the coast of Texas on Aug. 16 was one of the most severe in the history of Gulf storms and raised havoc with overhead electric light, telephone and telegraph circuits. Although the storm centered at Galveston, much damage was reported from other portions of the State. Electric light, telegraph and railway service was demoralized along the coast. The Galveston Electric Company, operating the local railway lines, and the Galveston-Houston Electric Railway were the hardest hit. The Brush Electric Company, operating in Galveston, reports: "Damage to our plants practically nil. Only damage suffered was to line." Wires and poles in Galveston, however, were a tangled mass.

The main power station of the Galveston-Houston Electric Railway at League City was damaged by the salt water, which filled the pits and covered the turbines. The relay station at Lamarque was forced to suspend, but the extent of damage is not yet known. Only random poles remained between Highland Park and Galveston.

The city of Houston fared little better than Galveston as to wires and poles. Except for a few washouts the tracks of the Houston Electric Street Railway were not seriously damaged and service was restored to normal within a few days. The Beaumont-Port Arthur Interurban Railway had to discontinue service on the afternoon of Aug. 16 when water submerged the tracks. The Southwestern Traction Company, operating between Belton and Temple, suffered only from trouble caused by wind. No serious damage was sustained by the Texas Power & Light Company properties. Reports indicate that the newspaper accounts of damage were greatly exaggerated.

Labor Troubles in Bridgeport

The European war, which has kept Bridgeport (Conn.) factories on the rush to fill war orders, has brought with it the unionizing of the city by organized labor. The manufacturers of firearms quickly came to an agreement with the labor leaders, and the workmen in the numerous other industries in Bridgeport also responded to the call to organize. Thus, for the first time in its history, Bridgeport, which is one of the largest manufacturing centers in New England, is no longer an open-shop town. Manufacturers of electrical apparatus were not immune from the movement, and most of the large companies have granted a forty-eight-hour week with the same pay as for fifty-five hours. In some of the electrical companies other demands have been made and refused. Among the manufacturers of electrical apparatus reported to have had trouble with labor leaders are the Bridgeport Brass Company, the Connecticut Electrical Manufacturing Company, the Bryant Electric Company, Harvey Hubbell, Inc., and the Perkins Electric Switch Manufacturing Company. At the shops of the Bryant Electric Company the workmen walked out after the company had granted a forty-eight-hour week and made further demands for increased wages, etc. The demands made on the Connecticut Electric Manufacturing Company were for a forty-eight-hour week with sixty hours' pay, double pay for overtime, and additional increase in wages over that asked for the short time. What effect the unionizing of all classes of workmen is going to have on the future of the city is largely problematical. Conditions at present are so abnormal that it is impossible to state what the final outcome will be. The strikes have not embarrassed the electrical manufacturing companies, which are filling orders as usual.

CONCENTRIC WIRING DISCUSSED

International Association of Municipal Electricians Brings Up the Subject at Annual Meeting in Cincinnati

Concentric wiring was one of the main topics of discussion and action at the twentieth annual convention of the International Association of Municipal Electricians, held at the Hotel Gibson, Cincinnati, Ohio, this week. The convention was opened with an informal reception at the hotel on Tuesday evening, and the delegates were welcomed by Mayor Spiegel and other city officials and representatives of the Chamber of Commerce. President W. H. Flandreau of the association, city electrician of Mount Vernon, N. Y.; Dr. C. P. Steinmetz, consulting engineer of the General Electric Company, and Messrs. J. B. Yeakle, Baltimore, and W. Y. Ellett, Elmira, N. Y., responded.

Control of Electric Power

In beginning Dr. Steinmetz gave an abstract of an address made by him last year at Franklin Institute, Philadelphia, on the development of electric power and then elaborated the idea and showed the great increase in the scope of the association which is now taking place. One of the most important public functions, he said, is the safeguarding of energy. This is one of the chief duties of municipal electricians. It is of very high serial importance and of great potential power. The population of the cities represented in the association is over 30,000,000, so that a considerable part of the United States is interested in the control of electrical energy and therefore more or less interested in the association.

Electric power, Dr. Steinmetz added, has really become of general importance and use only in the last ten or fifteen years. Although the association is much older than this, its activities were represented at first by the care of police and fire-alarm signaling systems. Only the younger generation has dealt with power engineering. In the last year the problem of control of high-power systems has entered, and the association is changing by beginning to take more interest in engineering matters of far greater importance. It now touches matters of high potential line construction and lighting and co-operates with the Bureau of Standards. The association does not intend, said Dr. Steinmetz, to enter very deeply into the question of specifications. It will prefer, rather, to co-operate with the Bureau of Standards. This body is not controlled by any special interest, and its recommendations would be considered by the association.

Concentric Wiring

During his opening remarks at the formal business session on Wednesday, President Flandreau suggested the appointment of a membership committee, consisting of a member from each State. In speaking of the activities of the association and its far-reaching connections, he paid a tribute to the ELECTRICAL WORLD. In introducing Mr. R. A. Smith, city electrician of Norfolk, Va., who read a paper on "The Advisability of Using Concentric Wiring in This Country," President Flandreau called attention to the importance of the topic.

Mr. Smith said that the object of the presentation of the paper was to bring before the members the possibility of a reduction in the cost of wiring and a lessening of the fire hazard from the use of oil and gas in smaller residences, where the new system would permit the introduction of electricity. The interest in a system of grounded concentric wiring, Mr. Smith said, has arisen chiefly from two considerations—first, a desire for a system of wiring possessing advantages of low cost, ease of installation and good appearance; second, a desire to protect persons against injury by the use of a grounded system having no underground exposed energy-carrying parts. He quoted the rules which have been submitted to the special committee of the National Fire Protection Association. In so doing he stated that they are only a partial outline of possible future requirements and are subject to revision, modification and extension resulting from further information and experience.

From these rules Mr. Smith noted that some of the dangers anticipated are as follows: In the event that a portion of the outer conductor or sheath becomes disconnected and ungrounded it becomes a source of danger. In the event that a loose connection develops in the outer sheath or conductor sparking or heating occurs, and it is exposed. The rule prohibiting the placing of switches or fuses in the outer conductor or sheath is absolutely necessary.

Mr. Smith declared that the subject is a live one and will come up again, and it deserves the earnest attention of all officials of municipal inspection departments. It is reasonable to expect that means will be found, he said, to overcome the difficulties in safeguarding this class of work. Notwithstanding the fact that many departments are rightly opposed to the adoption of this class of wiring, with the limited knowledge and incomplete specifications available at present, there is a demand for some cheap and safe method of installing branch circuits, and concentric wiring seems to be the nearest approach to this method possible at this time.

Manufacturers Interested in Any Change

It must be borne in mind, Mr. Smith continued, that large manufacturers of fittings for branch circuit work are vitally interested in any change of methods or fittings for this system and will be heard from whenever the subject is raised for discussion. Manufacturers deserve consideration when any radical changes are contemplated in the code, such consideration, however, being mainly in the nature of reasonable delay in putting new regulations into effect in order that the manufacturer may dispose of special machinery, which in many cases is costly. Time to absorb this asset should be given.

The question of possible danger from loose joints and broken ground connections in concentric wiring, which at first may appear to be a serious objection, is less important, Mr. Smith said, when it is considered that the system is suggested only for 660-watt branch circuits and is not to be concealed. After eighteen years' experience in inspection work, Mr. Smith declared that he anticipates no greater danger from this class of wiring than from some of the present approved systems. The steps which Mr. Smith advised members to take are to study the national code, subscribe to the laboratories' reports on approved fittings and materials, watch the amendments suggested to the code every two years, and, last but not least, have ordinances that will enable inspectors to enforce compliance with the rules.

Mr. Doane Outlines Advantages of System

At the morning session Mr. Smith's paper was discussed only briefly by Messrs. A. C. Farrand, Atlantic City, N. J., and J. B. Yeakle, Baltimore, Md. At the afternoon session Mr. S. E. Doane, chief engineer National Lamp Works of the General Electric Company, was asked to discuss the subject. In connection with his studies to increase lamp sales he found that in Europe there is a general effort to get small customers, while in this country the companies said very truly that they could not carry small customers on the lines and make money. The result was an investigation of

conditions in Europe, one man on the staff devoting a year to the study of why such customers could be carried there at a profit. There were several considerations involved, but the question of concentric wiring being understood so little in this country, that was generally the starting point of discussion.

Concentric wiring, in the opinion of Mr. Doane, is the best scheme advanced up to this time to connect generators and lamps. It is the least expensive one. Mr. Doane thinks that it is also the safest one. He described the construction of the wire, stating that it was developed in England, but that it had been put to maximum use in Germany. The wire chosen here is the English wire.

Concentric wiring, Mr. Doane continued, is not a remedy for all ills. It was developed originally to wire houses already constructed. If economically right and sound, this wire will be developed in this country. With knowledge of the very complete installations in Europe, it is impossible to feel otherwise than that many uses for it will be found here. Mr. Doane said that he feared more for the success of a movement of this sort from over-enthusiastic friends than from those who opposed it.

Several delegates mentioned instances of inexpensive wiring some years ago. Mr. F. A. Barron, General Electric Company, submitted samples of bare concentric wire. President Flandreau suggested the appointment of a committee to study the subject, compile data on it, and keep members informed regarding the advisability of the introduction of the system here. The committee was authorized.

Dr. Steinmetz on Concentric Wire

Dr. Steinmetz said that concentric wiring in this country is not entirely new. Concentric wiring with underground cable is used to a very large extent for safety; for instance, large railway systems are installing cable in that way. The proposition now is to introduce concentric wiring, for the reason that with the concentric conductor, in case there is a fault, the current goes quickly from one conductor to the other conductor, and if the outer conductor is grounded it is all right. If it is not concentric wiring and an attempt is made to insulate the second conductor, and one fails, the current, before it finds a return, meanders all over. In signaling circuits the closed-circuit system is the only reliable one. Any open circuit is unsafe, because something may happen. With a closed circuit if anything happens a signal is given. The comparison between that and between standard and concentric wiring is much the same. In concentric wiring if the ground fails the lights go out. In large degree the grounds relied on for protection are not good when anything goes wrong. Theoretically concentric wiring should be safer because a ground is sure and there can be no currents meandering through the house, since the only path the current can follow is from one conductor to the outer shell and from there to ground.

Louisville Jovians to Boost "Prosperity Week"

Every influence which can be made to serve the occasion will be brought to bear by the Louisville (Ky.) Jovian League in connection with "Electrical Prosperity Week," according to plans of the members of that organization. One of the features will be a parade of all available electrically propelled vehicles in Louisville and vicinity, while efforts will be made to enlist not only the electrical interests of the city but all local commercial interests in support of the campaign. Under the direction of Mr. Robert Montgomery of the Louisville Gas & Electric Company, a committee of Jovians will prepare a census of electrical workers in Louisville. Starting with the Louisville Gas & Electric Company, the Louisville Railway Company and the telephone and telegraph companies, it is estimated that the list will show perhaps that 10 per cent of Louisville's workers and those dependent on them represent electrical interests, with a payroll probably larger than the numbers would indicate. With a showing like this it is believed that the merchants of the city can be stirred up to active interest in the project, and that they will co-operate in the celebration by decorating their stores and emphasizing for the week what they handle and use in the electrical line.

N. E. L. A. COMMERCIAL SECTION PLANS

Chairman Becker Wants to Reach and Hold the Interest of Men in the Ranks of the Industry

Plans of the Commercial Section of the National Electric Light Association for the coming year are receiving careful consideration. In discussing them with a representative of the ELECTRICAL WORLD, the chairman, Mr. J. F. Becker, general sales manager of the United Electric Light & Power Company of New York, outlined several ideas for development through more active co-operation of the committees and members.

One thought which Mr. Becker expressed is that the Commercial Section shall get closer to the "men on the firing line." "The man who is soliciting contracts for electric light," he said, "is not interested in the theory and operation of electric furnaces. He works by different methods on lines entirely different from the man who solicits the larger contracts. We want to give the man who handles the smaller contracts an opportunity to learn. We want to have him find out how advertising can assist him and how he can help the advertising man."

In this work particularly Mr. Becker seeks the co-operation of members. "The Commercial Section is not a one-man proposition," he declared, "and all that the chairman can do is to give his individuality to it in order to make as much progress as possible during his term of office. The work becomes effective because the executive and other committees carry it through." Mr. Becker continued:

Education for Salesmen

"One plan is that we shall give most cordial support to the committee on education of salesmen, of which Mr. Fred R. Jenkins of Chicago is chairman. To the man in the ranks this committee now offers an opportunity to learn the fundamentals of the business. He can learn from practical, not scientific facts. If we make a success of this movement we shall do a great deal to establish the Commercial Section on a sound basis for greatly enlarged activities in the future. The commercial engineering course, as the committee calls it, is in four parts, covering selling, metering and rates, lighting and power. In the commercial department of this company thirty or forty men will take the course. Some men from other departments may also take advantage of it. If paid in advance, the cost of the full course is $12. The cost, if paid quarterly in advance, is $16. Our company will finance the course for the men, paying the tuition in advance, with the understanding that the men will pay back $1 per month, but that if in their examinations they show a percentage over 75 we will return the money to them."

A Session for "Practical" Men

Mr. Becker also has in mind the creation of a "practical" session at the convention in order to hold the

interest of the men he hopes to reach. "In recent years," he continued, "the commercial business has become extremely technical. We get many men for work which requires college training. To other men the work which the college-educated men do is mysterious. Let the mysteries remain with the mysterious men, and let us furnish facts adapted to the training and every-day business of the practical men and thus hold that great body of workers."

To emphasize the importance of attracting younger men to the conventions, the new chairman of the Commercial Section mentioned his experience at the 1907 annual meeting, held in Washington. He was a meterman then, and it meant a good deal to him to attend the convention. After hearing the discussions he decided that he would be a commercial man. "I was thoroughly interested in that convention," Mr. Becker added. "Even now the proceedings are very interesting to me. I have read them over and over again.

"Many men in the business to-day did not have a convention to guide them along roads that would lead to development," he went on. "Generally the commercial departments were just getting well started when I made my change. This is a day of specialties. The commercial departments are highly organized, and much that they do is over the heads of the men who are doing part of the work. We have encouraged these men to become members, and we do not want to let them feel in any way that they are not being well repaid. The subjects that mean their every-day bread and butter should be taken up as one of the desirable activities of the Commercial Section."

Something for "the Many"

Mr. Becker said that his idea is to have at least one session of the 1916 convention devoted to simple commercial problems. "This would take up lighting and advertising and every man ought to get something out of it," he continued. "I have had a great deal from the Commercial Section, but we want to add something that will be not for the few but for the many. At the end of each year, when our younger members think over what they have had to pay them for their membership and trouble, we want to feel that they are well satisfied."

Mr. Becker also suggests the creation of a lighting bureau corresponding somewhat to the power sales bureau. The lighting bureau would form separate committees, possibly four or five, including an advertising committee. Mr. Becker believes that this will be an effective means of drawing and holding those who make contracts for residence lighting and the smaller central-station business.

When Mr. Becker was asked if he thought that business conditions would have any effect on the section he said: "They probably will retard committee work, but so far as the results for the convention are concerned I think that those will be overcome by the activity of a small number of the members who will take special pains to inject their personal ideas and work and will get concentrated material for reports. The committees will be selected as nearly as possible with the purpose of giving good representation to the different sections of the country. For instance, we have asked the Pacific Coast companies to recommend members. We also hope in this way to help to increase the membership. Of course, our thought is to increase the membership of the main body first and then to expect that the Commercial Section will be benefited."

Chairman Becker was asked to comment upon the suggestion of Mr. W. H. Atkins of Boston that special importance be directed this year to the commercial side of the industry. "The commercial men," he replied, "may get a large power contract with a poor load-factor. The engineer could do a great deal to guide the commercial man. In every step there should be an operating point of view as well as a commercial one. It is highly important that the two should be co-ordinated. The engineer can point out the different considerations which are of importance to him, and the commercial man can act upon them. As I understand it, the suggestion of Mr. Atkins is that there shall be a greater degree of activity in commercial matters by the engineering and operating departments. This is very important, and it will be beneficial. The Commercial Section will be very glad to co-operate in any way with such a movement.

"The section also proposes to co-operate with the Society for Electrical Development, and it has so pledged itself. What it does to further the celebration of 'Electrical Prosperity Week' will be done through the individual activities of the members, however, and not directly as a commercial section."

CONVENTIONS DURING SEPTEMBER

Important Meetings Scheduled for National and State Bodies in All Sections of the Country

During the month of September there are usually held more conventions of interest to the electrical fraternity than during any other month of the year. In addition to the regular meetings which ordinarily are held during September there will be convened this year the International Engineering Congress in San Francisco. Preceding the congress many national bodies will also hold sessions on the Pacific Coast. Among those which will meet in San Francisco during September are the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Electrochemical Society, the Institute of Radio Engineers, and the Telephone Pioneers of America.

Other national bodies holding conventions during September are the Association of Edison Illuminating Companies, the Electrical Supply Jobbers' Association, the Illuminating Engineering Society, and the Association of Iron and Steel Electrical Engineers. A list of the most important meetings scheduled for the month is given herewith in the order of their occurrence:

Date	Association	Place
Sept. 8-10	Pennsylvania Electric Association,	Bedford Springs, Pa.
Sept. 8-10	Indiana Electric Association	Terre Haute, Ind.
Sept. 8-11	Northwest Electric Light and Power Association,	Portland, Ore.
Sept. 8-11	Institute of Iron and Steel Electrical Engineers,	Detroit, Mich.
Sept. 13-15	Association of Edison Illuminating Companies,	Spring Lake, N. J.
Sept. 13-18	Institute of Radio Engineers	San Francisco, Cal.
Sept. 14-16	Electrical Supply Jobbers' Association,	Niagara Falls, Ont.
Sept. 14-17	New England Section, N. E. L. A.	Mount Kineo, Me.
Sept. 16-18	American Electrochemical Society,	San Francisco, Cal.
Sept. 16-18	American Institute of Electrical Engineers,	San Francisco, Cal.
Sept. 20-23	Illuminating Engineering Society	Washington, D. C.
Sept. 21-23	Telephone Pioneers of America	San Francisco, Cal.
Sept. 20-25	International Engineering Congress,	San Francisco, Cal.
Sept. 21-23	Water Power Conference	Portland, Ore.
Sept. 22-24	Southeastern Section N. E. L. A.	Asheville, N. C.

A notice of the International Engineering Congress, together with a list of papers of interest to the electrical engineering profession, is published elsewhere in this issue.

BOOSTING "ELECTRICS" IN NEW ENGLAND

Committee of Manufacturers of Vehicles, Batteries and Accessories Suggests Plan for Central-Station Co-operation

The central stations of New England have had presented to them by a committee of manufacturers a plan for increasing the use of electric vehicles based on a co-operative policy as outlined below. In presenting the proposition to the lighting companies the committee points out that the earnings to be derived from the extensive use of electric vehicles make it a matter of importance to the central stations to use their influence in the right way to promote their rapid adoption for pleasure and commercial purposes. It says that the best method of adding the needed stimulus of central-station assistance has been sought frequently and earnestly by all concerned, and claims that the plan outlined possesses merit and is entirely feasible. The committee, representing manufacturers of electric vehicles, batteries and accessories, is convinced that the adoption of such a policy will result in the development so mutually desirable.

Advantages of Electric Vehicles

The committee has enumerated six distinct reasons why electric vehicles should be installed and why central stations should adopt the policy outlined. These are as follows:

"First—You will admit at the outset that in order to put the use of electric vehicles on a sound and permanent basis it is essential that every economy possible of attainment from their use be made available to the present or prospective user. No other policy can insure success.

"Second—It is a recognized fact that the transportation of merchandise can be done with economy by horses, gas trucks or electric trucks. That a proper selection of the correct method of haulage depends upon an intelligent study of the individual case is self-evident. Any such study will quickly reveal that in many cases the margin of saving from the use of either the gas or electric truck in preference to the horse is small and frequently intangible to a prospective user of gas or electric trucks.

"Third—If the selection of the type of delivery system best suited to serve the needs of individual customers varies with conditions, it must be admitted that the method of operating the selected system is none the less open to investigation and must also be considered carefully in connection with the system selected and operation required.

"Fourth—Recollect that electric vehicles can be operated with economy either by the use of a battery exchange system or individual charging boards, and here again the better of the two methods must be determined by an analysis of the prevailing or expected conditions. It is also important to remember that with the standardization of both of these methods of charging the central station is in a position to meet every application with its proper solution, resulting in a larger profit than if either method is advocated to the complete or partial exclusion of the other.

"Fifth—It is obvious that the slowness of the public in general to adopt the electric truck in any fair proportion to its advantages is due mainly to popular impression that anything electrical is actuated by some mysterious power capable of control and, in the cases where storage batteries are concerned, of replenishment only when handled by men specially versed in the art.

"Sixth—It is admitted that within its proper radius of action an electric truck will operate at a saving of from 20 per cent to 50 per cent over a gas truck. The incomparable advantages of an electric pleasure vehicle, when it is used within its sphere, have long since ceased to be disputed. Nevertheless the use of gas trucks and pleasure cars is increasing at a much faster rate than is the case with the electric vehicle. What a monument to misconception! And what a splendid opportunity awaits any central-station manager who will consider carefully, plan broadly and act fairly!

"Let the public served by you realize that you are using and can honestly recommend electric vehicles. Establish two general methods of charging—first, offer a battery-exchange plan, open on the equal terms required of a public service corporation to any applicant; second, make charges by means of individual charging boards owned and operated by your customer. Also establish a bureau of information for present and future users of electric vehicles in your territory, from which bureau information helpful to the trade should be issued to it simultaneously and with exact impartiality."

Suggestions to Central-Station Managers

In explanation of the plan above outlined the committee says:

"First, it states that you are to use and recommend electric vehicles where proper to do so. Surely no hardship is imposed by such a requirement. Can any manager grumble at double profits secured from the modern tendency of rate reduction?

"Next, establish two general methods of charging. Why not establish and encourage as many different methods as will serve electric-vehicle users to their profit and satisfaction, thus increasing the permanent revenue of the central station and enabling it to build up its 'off-peak' load at a fraction of the effort expended at present to fill up the valleys in the load curve? And what is there new, novel or exacting in either of the general schemes of charging proposed under this plan? The battery-exchange plan is old. It is now available with equal facility for any make of truck, owing tc the use of universal battery compartments by all the leading makers of vehicles, and standard battery dimensions have long ago been realized within easy working limits. This plan of charging presents no difficulties to the central station, and its adoption as a stimulus to the industry will be beneficial indeed, especially as public service officials will realize, without the necessity of illustrative examples, the prime importance of preventing the public from gaining the impression that the central station can or will favor special interests. The handicaps of individual charging have been removed with the perfection of the batteries and introduction of simpler and fool-proof control equipment. Such individual charging installations should always be advised by the central station when prevailing conditions make it possible for the user to avoid the overhead charges of the battery-exchange or mileage plan of service. And to follow such a plan means more revenue for the central station resulting from the sale of energy minus extras; that is, gives you the maximum possible profit and automatically brings the user nearer to the economic ideal. Indorsement of the charging-at-home plan will offset the inference created by the establishment of a universal battery exchange, that electric vehicles are still in the infantile stage and require trained nurses, and thus make it possible for the central station to furnish this double service without the possibility of inadvertently destroying the paramount simplicity argument of the electric-vehicle salesmen.

"And, finally, the wisdom of bureaus of information maintained by central stations to capitalize their local prestige is unquestioned to-day. The civic trend of

modern times makes it as foolish as it is futile to attempt to develop any great instrument or institution of public service along the lines which savor of favoritism or monopoly.

"A representative committee is ready to assist you in the perfection of the plan outlined above."

The letter is signed by Mr. M. E. Brackett, Boston branch manager General Motors Truck Company, as chairman, and a committee comprising Messrs. Floyd T. Taylor, district sales manager Cutler-Hammer Manufacturing Company; R. B. Daggett, manager New England district Commercial Truck Company of America; P. E. Kelley, manager Boston office Philadelphia Storage Battery Company; George W. Holden, New England manager Edison Storage Battery Company; W. E. Haseltine, assistant general manager Holtzer-Cabot Electric Company; John A. White, New England manager United States Light & Heating Company; M. O. White, Boston manager Ohio Electric and Ward Electric Truck companies, and J. W. Emery, New England manager Walker Vehicle Company.

Court Decision in Public Service Gas Case

The decision of the Court of Errors and Appeals of New Jersey in the case affecting the rates of the Public Service Gas Company in the Passaic district, and upholding the order of the Board of Public Utility Commissioners, says in part:

"It is quite evident from the testimony and from the findings of the Supreme Court that, with the exception of the commercial value of the franchise, the term 'going value' in these cases embraced what the commission thought was the fair present value of all of the elements of the intangible property of the gas company, including the necessary spark of life represented by adequate permission to use its property for the purposes of its incorporation and in the public streets where it was locally authorized to go. To this extent I think the property of the gas company is entitled to protection in rate-making orders, because a failure of such protection permits confiscation. I agree, therefore, with the view of the commission upon this point. To value the present mere physical property of the company, in absolute disregard of its previously discharged burdens assumed and performed in the public interest and clearly contemplated by the legislation by which it was invited to enter upon the public service, is, in my judgment, confiscatory. Likewise, to value it without considering it as endowed with its life-giving permission to continue its public functions would be confiscation.

"It is quite evident that if the State for what reason soever (and many may be thought of) omits for a great number of years to enforce its rights, and thus allows the company to charge unreasonably high rates, and there seems every likelihood that this permission or omission will continue, the property value of the franchise in the open market, as reflected by the market value of the company's stock, will be much higher than it would be if the State had at all times and consistently enforced its rights and there was every prospect that it would continue to do so. Assuming, for the purpose of illustration, that an unreasonably high rate has been charged by this company in the past, upon what theory can it be contended that, because of this permissive omission on the part of the State in favor of the company during all these years, the State has now forfeited the rights of the public to enforce a condition which it was always the duty of the company to perform, whether the State compelled it to do so or not? I think there is none.

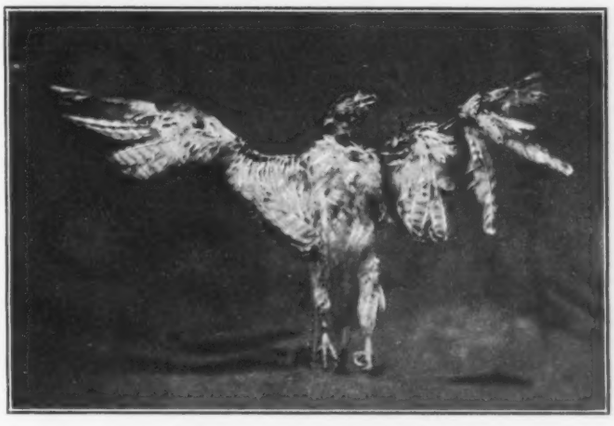
"Taking up the proposition that the company's charter right to charge reasonable rates is in itself a valuable property right entitled to consideration in rate-making, I suppose it must be conceded that the franchise to charge, as a 'reasonable rate,' sufficient to yield a net profit of 8 per cent on the value of the company's property, as allowed and established respectively by the findings of the utility commission in this case, is a very valuable property right. Certainly I think it is. That this valuable privilege is the company's is beyond question. That it is property is undoubted. That the law protects it against confiscation and subjects it to taxation follows as a matter of course. But that this valuable property right to charge 'reasonable rates' should, by virtue of its own existence, have the effect of converting itself into a still more valuable property right to charge 'unreasonable rates' is, of course, preposterous.

"That the company's contract with the State to charge 'reasonable rates' cannot be evaded is, of course, quite obvious. The plain fact is that the commercial value of the company's property right in its franchise can have no effect in fixing the rate it can charge, because by the terms of its contract with the State the stream of its franchise value arises from the spring of its right to charge 'reasonable rates,' and in the very nature of things no stream can rise higher than its source."

The Public Service Gas Company, against which the decision of the Board of Public Utility Commissioners is sustained, has announced that the case will be appealed to the United States Supreme Court.

Hawk Grounds Transmission Line

The accompanying illustration shows the remains of a common hawk which two weeks ago flew into the transmission lines of the Public Light & Power Company of Chattanooga, Tenn., near the lock and dam on the Tennessee River. During a storm in the valley of the Tennessee River the hawk, which measures 5 ft. from tip to tip of his wings, either flew into the circuit or, alighting on one phase, stretched his wings, making contact with one phase and the ground wire, which is 3 ft. from the nearest phase. The line in question operates at 44,000 volts, and it cost the company approximately $15 to remedy the trouble after it was located. Occurrences of this kind, while common in some sections of the country, are rather rare in the Tennessee River valley, but no matter where they occur they are beyond the control of transmission companies, a fact oftentimes lost sight of by the general public, which may be temporarily inconvenienced because of the failure of a transmission circuit from such cause.



CAUSE OF TROUBLE ON TENNESSEE TRANSMISSION LINE

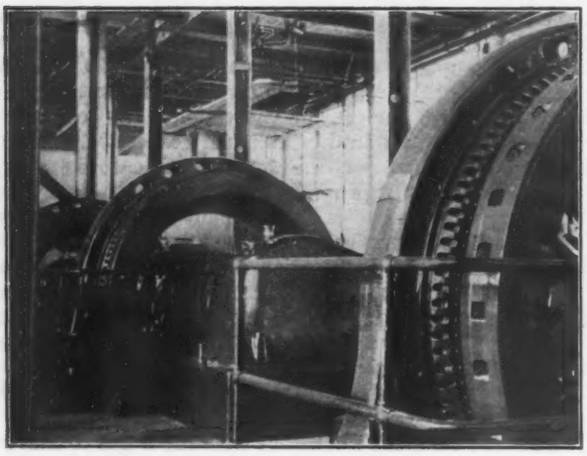


FIG. 1—GENERATORS IN COMMONWEALTH FISH PIER POWER PLANT

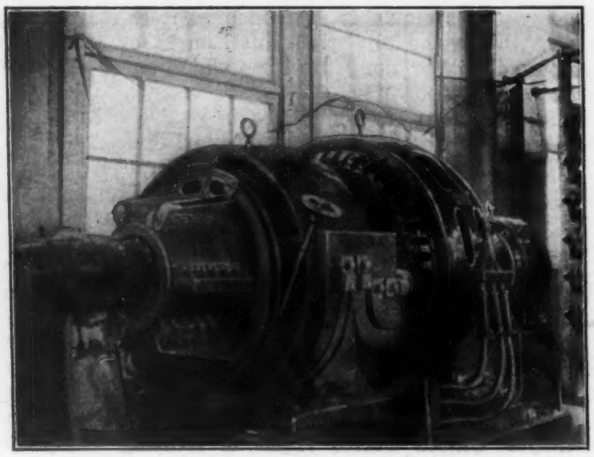


FIG. 2—SYNCHRONOUS MOTOR-GENERATOR SET FOR BATTERY CHARGING

How Electricity Is Used in Handling Sea-Food

Energy from Ice-Making and Refrigerating Plant Also Employed to Operate Motor-Driven Ice Hoists and Crushers—Use of Electric Trucks

THE Commonwealth Fish Pier, recently completed at Boston, Mass., is said to be the largest and best equipped plant in the world devoted to the handling of sea-food.

On property of the State of Massachusetts adjoining Commonwealth Pier No. 5 there have been erected two three-story brick and concrete buildings each 750 ft. long and 55 ft. 4 in. wide, with a court 129 ft. wide between. At the water end of the pier is a two-story brick and concrete building occupied by the Boston Fish Market Exchange, and at the street end of the pier are three reinforced-concrete buildings of four, five and eight stories respectively, forming a block, occupied by the Commonwealth Ice & Cold Storage Company as a power plant, refrigerating and cold-storage building and ice factory.

The long structures were built by the Boston Fish Market Corporation, which leases the ground from the port directors and rents the stores to forty-five fish concerns. The power plant, refrigeration and ice factory are the property of the Commonwealth Ice & Cold Storage Company, as is also the building, which was erected on land of the State, leased through the port directors.

Ice-Making and Refrigeration Plant

The power plant for ice making and refrigeration consists of four steam-operated compressor units which drive ammonia compressors. Otherwise the power employed in the plant is electrical. About 400 hp in motors is connected, and facilities are provided for charging the storage batteries of the electric locomotives and trucks used for distributing crushed ice and in conveying ice about the plant. The total normal load is about 550 kw. The generating units consist of two 180-kw Triumph alternators equipped with flywheels, each direct-connected to a 14-in. by 19-in. steam engine built by the Erie City Iron Works and operating at 200 r.p.m., and one 240-kva Triumph alternator with flywheel, directly connected to a 15-in. by 18-in. Erie City engine operating at 257 r.p.m. Mounted on the outer end of the same shaft with the generating units is a 10-kw, 125-volt exciter.

The generating units furnish three-phase, sixty-cycle energy at 230 volts for motor service. A Triumph motor-generator is provided for charging the storage batteries. This unit consists of a 175-hp, 220-volt synchronous motor operating at 900 r.p.m., a 100-kw generator, directly connected, providing direct current at 125 volts, and a 10-kw exciter.

Details of the Equipment

The switchboard for battery-charging services is at the end of the main switchboard and consists of six panels. The storage-battery cars comprise three General Vehicle Company trucks of 5 tons capacity each, used for hauling ice, fish and other materials about the pier and occasionally into the city, and two electric locomotives used for hauling cars of crushed ice on the roof to the various concerns occupying stores on the pier. These tractors are each of 5 tons hauling capacity and were manufactured by the Automatic Transportation Company, of Buffalo, N. Y. The battery equipment is 22 Edison cells on each tractor. A single outlet for charging is provided on the roof, where the locomotives are kept outdoors, to be housed later in a shed. The cars are of the automatic-dumping type and have sheet-steel bodies holding about 1000 lb. of ice each. A U-shaped track extends from the ice chute the length of each building, crossing between buildings on a structural steel bridge. The total length of track is about 1800 ft.

The crushing plant is on the top floor of the ice plant, and ice falls to the cars and is hauled by the tractor to a point opposite a chute leading to the store below and emptied through a trap door, numbered to designate the firm occupying the store. The dispatcher when sending out a trainload of ice (two to five cars) specifies the numbers of the stores to which it is to be delivered.

There are four 7.5-hp Triumph motors operating De Laval centrifugal pumps with a rating of 250 gal. per minute, pumping brine to the ice tanks; four 10-hp Triumph motors operating pumps with a rating of 350 gal. per minute, pumping salt water to the ammonia and steam condensers; two 3-hp General Electric motors operating triplex pumps for pumping warm water from

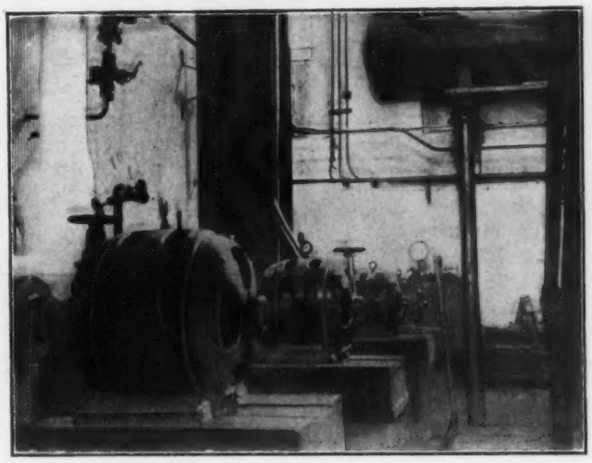


FIG. 3—MOTOR-DRIVEN BRINE PUMPS IN REFRIGERATING PLANT

FIG. 5—A 5-TON ELECTRIC TRUCK USED IN HANDLING SEA-FOOD

the steam condensers to the ice-making plant for heating the ice tins to give release to the ice cakes, and one 20-hp Triumph motor driving a De Laval sea-water pump supplying water for washing docks and stores.

Six Sprague motors of 5-hp rating operate 0.5-ton hoists for elevating ice cans from the refrigerating tanks, six 10-hp Triumph motors operate agitators in the ice tanks, and two 7.5-hp Triumph motors run the blowers for four coolers.

In the ice-crushing room are two 10-hp Crocker-Wheeler motors which operate three ice crushers from a line shaft; the crushers can take care of 45 tons of ice an hour.

Four 20-hp motors operate four Otis 5-ton elevators, two serving the several floors of the cold-storage and the ice-making plant. Two 7.5-hp General Electric motors operate ice elevators to raise ice cakes, two at a time, from the gallery of the ice-making room to the ice-crusher floor.

Electrical energy from the generating plant is supplied to the Booth Fisheries Company, occupant of Store No. 33 on the pier, to operate a refrigeration installation. Here two 30-hp Crocker-Wheeler induction motors operate the compressors and are installed in a monitor on the roof.

The buildings containing the plant of the Cold Storage Company were constructed by the Aberthaw Construction Company, Boston. The electrical apparatus was installed by the companies furnishing the same, and the wiring was by the Lord Electric Company, Boston. Mr. Arthur E. Smith is chief engineer of the Commonwealth Ice & Cold Storage Company.

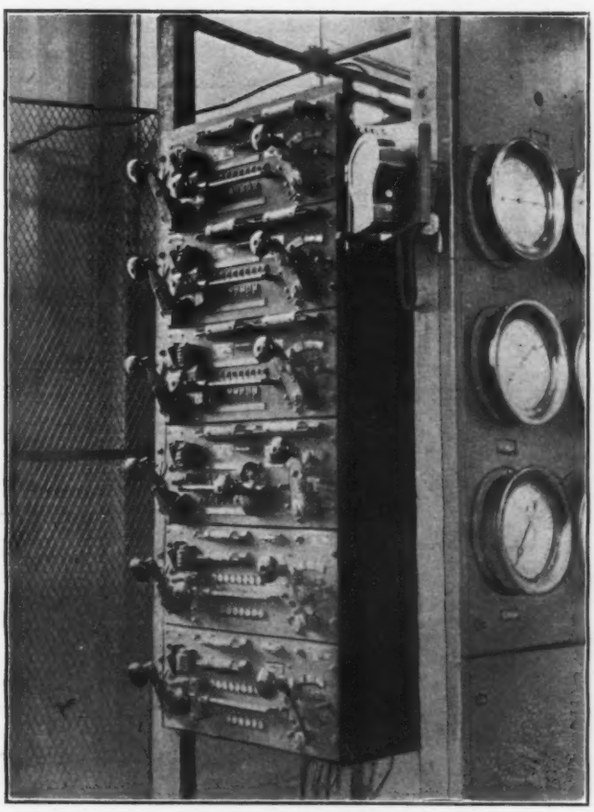


FIG. 4—STORAGE-BATTERY CHARGING PANEL, COMMONWEALTH FISH PIER

FIG. 6—STORAGE-BATTERY LOCOMOTIVE HANDLING CARS OF CRUSHED ICE

Flame-Arc Lighting of Indianapolis' Streets

Construction of a Complete 2632-Lamp System for City of 250,000 in Ninety Days, at a Cost of $750,000

PRIOR to December, 1914, the Merchants' Heat & Light Company of Indianapolis, Ind., was not engaged in the street-lighting business. It did not at that time own a foot of street-lighting circuit nor a single street lamp. By March 15, 1915, however, the construction forces of the company had within ninety days placed a lamp on practically every street corner in the city, and had installed all of the apparatus and lines necessary to supply electrical energy to the elaborate new street-lighting system. Long before April 1, the date on which the company's contract with the city specified that the new lighting should be in operation, all the circuits had been tested and operated, and each of the company's 2632 flame-arc lamps was known to be ready for actual service.

During the period of construction work was pushed with such vigor that new records for rapid erection were established each day, only to be broken on the following day. The working force consisted of sixteen line gangs each composed of one foreman, six linemen and seven groundmen. On the average, this force of men, using numerous wagons, trucks and four-pole derricks, put cross-arms on and set 180 poles a day, while the maximum one day's work consisted in setting 275 poles. The average day's work in stringing wire consisted of putting up 5 tons of No. 6 wire, while the greatest amount put up in any one day was 7.5 tons.

Details of Pole-Line Construction

The poles used are of Western cedar with 8-in. tops or larger, and vary in length from 35 ft. to 60 ft. Each pole was butt-treated and will ultimately receive two coats of green paint. Douglas-fir cross-arms, of N. E. L. A. standard dimensions, are used exclusively. They were dipped in green paint to match the poles, and were fitted with pins and braces in the storehouse, in order to facilitate the installation work. White porcelain insulators have been used throughout, except at dead-end points, where glass has been substituted. Deep-grooved, double-petticoat glass insulators were selected for dead-ending because the particular design of porcelain insulator employed did not place the mechanical strain low enough on the pin. Brown porcelain insulators are used for primary wires on top cross-arms, and white insulators on lower arms for the arc-lighting circuits.

Some idea of the magnitude of the installation and the amount of work involved may be gained from the fact that the underground portion of the distribution system required the installation of a number of additional conduits and manholes, 216 laterals from existing manholes, and 110,000 ft. of No. 8 varnished-cloth, lead-covered, steel-tape-armored cable. The overhead portion of the system required 18,000 wooden poles, of specifications previously given, 441 cast-iron columns, 2416 suspension arms, 216 ornamental tubular iron lamp columns, 30,000 cross-arms, 50,000 insulators and 664 miles (4,380,000 ft.) of No. 6 weatherproof arc circuit wire.

The arc lamps themselves are of the Westinghouse series flame-carbon type. The carbons are arranged vertically, thus delivering maximum candle-power close to the horizontal plane, which adapts them particularly for the lighting of streets, parks and large areas. The arc is steadied and its even burning insured by the compensation of all magnetic fields by a series coil, the flux of which counteracts the effect produced on the arc by the magnetic effect of the current flowing through the supporting casting of the lower carbon. A life of 130 hours per trim is obtained with carbons which measure 0.875 in. by 14 in. and which are impregnated. The light from the lamps is white in color.

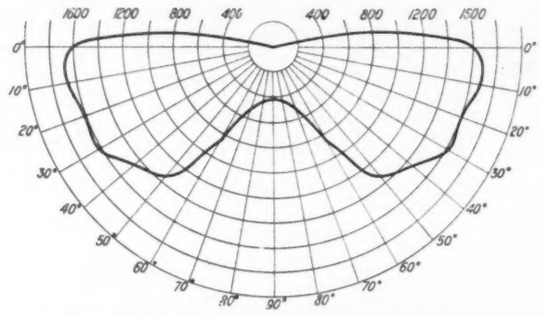
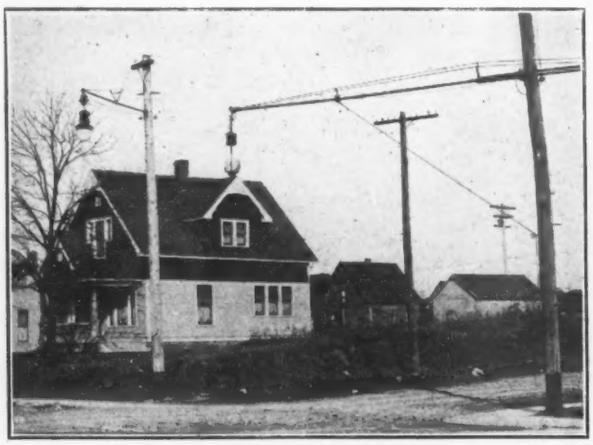
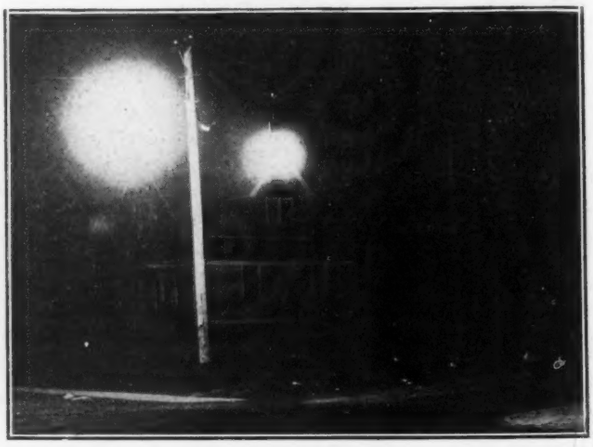


FIG. 1—CURVE SHOWING DISTRIBUTION OF LIGHT FROM FLAME-ARC LAMP AT INDIANAPOLIS





FIGS. 2 AND 3—THE NEW AND THE OLD ARC-LAMP INSTALLATIONS AS THEY APPEARED BY DAY AND BY NIGHT—INDIANAPOLIS STREET LIGHTING

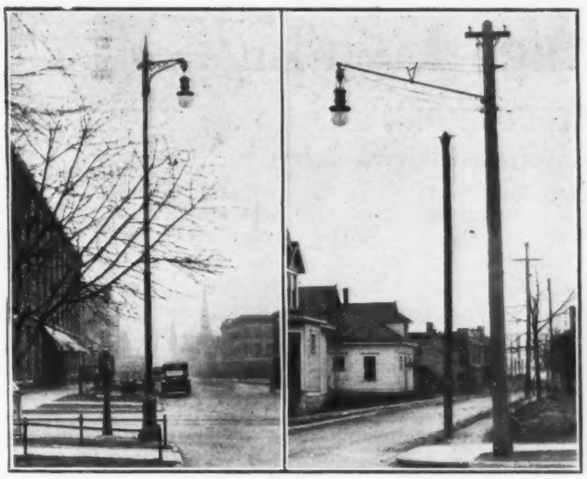


FIG. 4—CHARACTERISTIC INSTALLATIONS IN DOWNTOWN AND RESIDENTIAL SECTIONS OF CITY

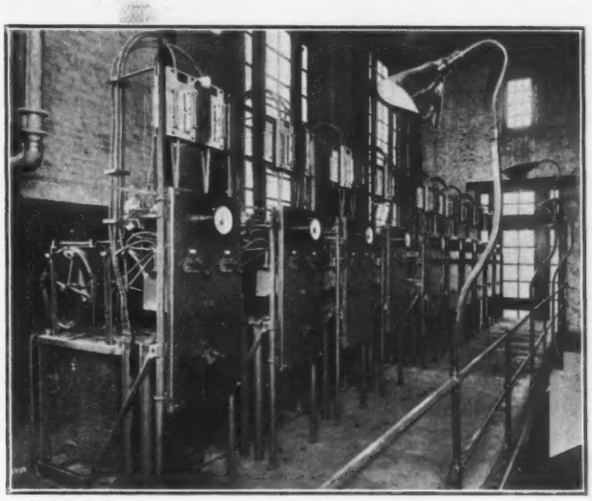


FIG. 5—INTERIOR OF STREET-LIGHTING SUBSTATION, SHOWING CONSTANT-CURRENT TRANSFORMER APPARATUS

The lamps are equipped with clear inner globes and slightly opalescent "Marbo" outer globes. The mounting height is 22 ft. above street level, except in a few special cases.

The approximate specifications and performance of the lamps are as follows: Current, 10 amp.; terminal potential, 55 volts; arc potential, 49 volts; power factor, 81 per cent; watts per lamp, 445, and electrical efficiency, 88 per cent.

The distribution of light and maximum candle-power are given in the curve shown in Fig. 1.

The suspension arms are of the Cutter type, 12 ft. long, and are equipped with Cutter automatic cut-outs so that the lamp can be lowered for trimming or inspection with safety. At each arc lamp Pierce pins have been employed to carry the two leads from the cross-arm down opposite sides of the pole to the suspension arm. In some instances as many as twelve of these pins are employed to insure safety. Rope 0.375 in. in diameter, instead of steel chain, is employed for lowering the lamps. The end of each rope is attached to a pole lock in order to prevent unauthorized persons or mischievous young folks from tampering with the lamps and equipment.

Energy Supply

Energy for operating the entire lighting system is supplied from three stations situated respectively in the eastern, western and northern portions of the city. This arrangement of energy supply centers permitted considerable economy to be effected in the construction and operation of the system. Eleven 68-kva. two-circuit, 10-amp. Westinghouse constant-current regulating transformers have been placed at each station, thus providing for several spare circuits in case of trouble. The arc lamps and incandescent lamps having the same current rating are all operated successfully on the same circuits, the transformers being designed for this class of service.

The series regulating transformers, operating from a constant-potential circuit, furnish constant current to the alternating-current series lighting circuits. They are designed to supply 100 arc lamps or their equivalent, plus a 5 per cent ohmic loss and a 10 per cent reactive drop.

The total connected load imposed upon the company's stations by the arc lighting described herein and by the incandescent street and park lighting described in the May 8, 1915, issue of the ELECTRICAL WORLD is given in the accompanying table.

All of the work of installation on the Indianapolis street-lighting system was done by the Merchants' Heat & Light Company under the personal supervision of its electrical engineer, Mr. A. J. Goedjen.

STREET AND PARK LIGHTING LOAD OF MERCHANTS' HEAT & LIGHT COMPANY, INDIANAPOLIS

	Number	Watts Each	Apparent Watts Each	Power-Factor, per Cent	Total Kw.	Total Kva.
Flame carbon arc lamps, 10-amp. series	2632	445	550	81	1171.2	1447.6
Gas-filled tungsten lamps—10-amp. series, 150 cp.	253	110	.....	.....	27.8	....
Gas-filled tungsten lamps—10-amp. series, 250 cp.	195	170	.....	.....	33.1	....
Total load					1232.1	1508.5

FIG. 6—A FEW OF THE 18,000 STRAIGHT CEDAR POLES, WITH DIPPED CROSS-ARMS AND PORCELAIN INSULATORS

Mobile Color and Stage Lighting—V

Problems to Be Solved in the Selection and Production of Color Filters—Transmission Coefficients and Energy-Distribution Curves

BY BASSETT JONES

ARTISTIC stage lighting by means of specially designed lamps and appliances has been considered in the four previous installments of this article. Last week the principles involved in the selection of pigments and dyes were dealt with, and below is a discussion of color filters which brings the article to a close.

As has already been stated, the selection and production of suitable color filters present serious problems. For stage work glass filters are impracticable. They are entirely too fragile and, furthermore, absorb a large percentage of even the wave-lengths that it is desired to transmit. Dyed gelatine sheets have so far proved the most suitable media, but even these, while much cheaper than glass, are easily torn and in actual service have a short life. However, they are much easier to handle and carry than glass filters.

In Figs. 18 and 19 are given spectro-transmission curves for five standard gelatine filters of foreign make and quite commonly used for stage work. It is obvious that the red and green filters show marked diachromatism, transmitting a fairly large proportion of energy in the red end of the spectrum. Evidently the character of the incident light will determine the color of the light transmitted by these filters. The blue filter, No. 3, will transmit a very pure blue when daylight is the source of energy and a purple when a low-efficiency lamp is the energy source. What this means, even for a comparatively slight difference in source efficiency, is shown in Fig. 20. Here the transmission coefficients of filters No. 3 and No. 4 are applied to the energy distribution curve of the 1.20-watt-per-candle lamp and to the energy curve of the same lamp reduced in efficiency by dimming to 3.1 watts per candle—approximately to a color match with the 4.0-watts-per-candle carbon lamp.

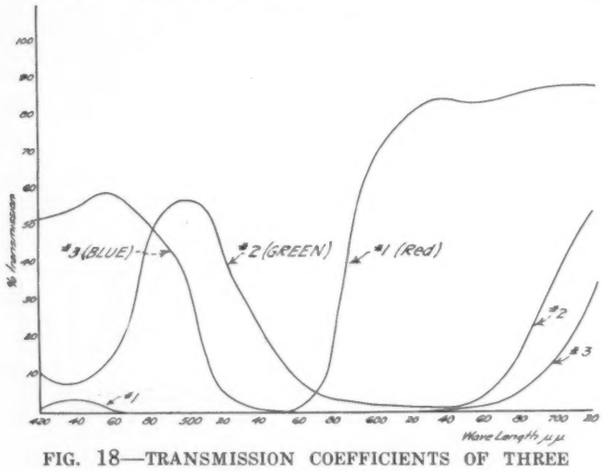


FIG. 18—TRANSMISSION COEFFICIENTS OF THREE COMMERCIAL FILTERS

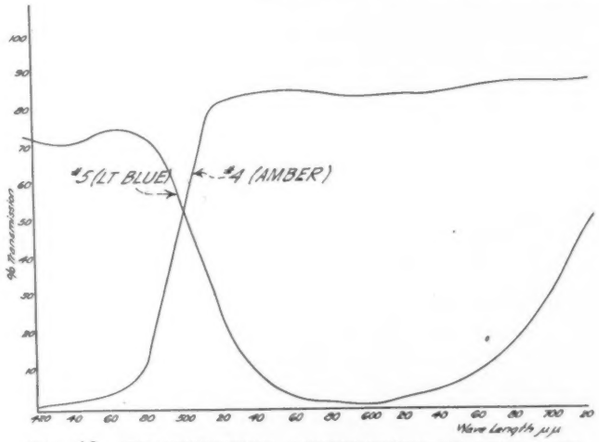


FIG. 19—TRANSMISSION COEFFICIENTS OF BLUE AND AMBER FILTERS

The actual range of lamp efficiency demanded in stage service is considerably greater than that given in the example of Fig. 20, for frequently the lamps will be dimmed to "cherry red," which approximately corresponds to a 95 per cent reduction in candle-power or in light flux.

With so marked a variation in efficiency and consequent variation in the proportion between the energy radiated in the longer and the shorter visible wave-lengths, coupled with diachromatic filters, it is practically impossible to produce good color values. Stage dawns are generally purple in cast. Stage moonlight has a reddish tone.

To correct these defects of the ordinary filters, the writer undertook the development of a series of filters corrected for diachromatism. Transmission coefficients for the corrected so-called red, green and blue filters are given in Fig. 21. These are of the vintage of 1913 and are to be taken as representing only the general character of the spectral transmission.

In preparing such filters for stage use several points must be kept in mind. The cost of the filters must not be unduly enhanced. Normally the best imported commercial filters may be purchased for 10 cents a sheet 20 in. by 20 in. Transmission data for such filters have been given in Figs. 18 and 19. The supply must be adequate. The colors must be permanent under ordinary conditions so that the filters may be kept in stock. As the filters will not last long in service, the colors need only be reasonably permanent when subjected to heat.

When the filters are used for synthetic illumination they must not only give good individual color but also reasonably good mixture color as well as a fair synthetic white approximating in energy distribution to daylight. A good psychological synthetic white is not sufficient as the color is never seen directly and any marked deviation from the energy distribution of daylight will cause color distortion on the scenery.

The requirements for good individual color and good energy distribution in synthetic color do not seem to be altogether compatible. An approximation only can be obtained, and the deviation, if marked, can be corrected to some extent by varying the color of the dyestuffs used in the scenery.

An approximation to daylight, taking the radiation of the black body at 5000 deg. Kelvin as standard, is shown in Fig. 22, using filters Nos. 1, 2 and 3. It will be seen how the diachromatism of the green (No. 2) and the blue (No. 3) affects the result by increasing

the red component. There is little yellow in the mixture, and only a very poor non-luminous psychological yellow can be obtained by using filters No. 1 and No. 2 alone. The synthetic white can be made a good psychological match for daylight, but physically it shows energy maxima in the green and extreme red. A dye such as Victoria green or methyl green would show up very prominently in comparison with aniline yellow, for instance. Yet another yellow dye that gets its color by transmitting both red and green might show up very well.

No attempt has been made in Fig. 22 to correct the energy values for the lowering of efficiency caused by dimmer adjustment of the flux emitted by the different sources. Such dimmer adjustment is required to produce a play of synthetic color through the color cycle by shifting the energy maximum. As previously pointed out (Fig. 20), this dimmer adjustment causes a change in the energy distribution of the radiation emitted by the lamp.

To allow for the variation in the efficiency of the lamps used, recourse may be had to the characteristics of the lamps as shown in Fig. 24, in which are plotted voltage candle-power and watts-per-candle characteristics for evacuated tungsten lamps operating normally at various efficiencies between 1.20 watts per candle and 0.7 watt per candle. To use these curves determine the percentage of decrease in candle-power required. From the proper point on the ordinate run in horizontally to the per-cent-volts-per-cent-candle-power curve. From this point run vertically to the proper per-cent-volts-watts-per-candle curve. Read increase in watts per candle and percentage of volts.

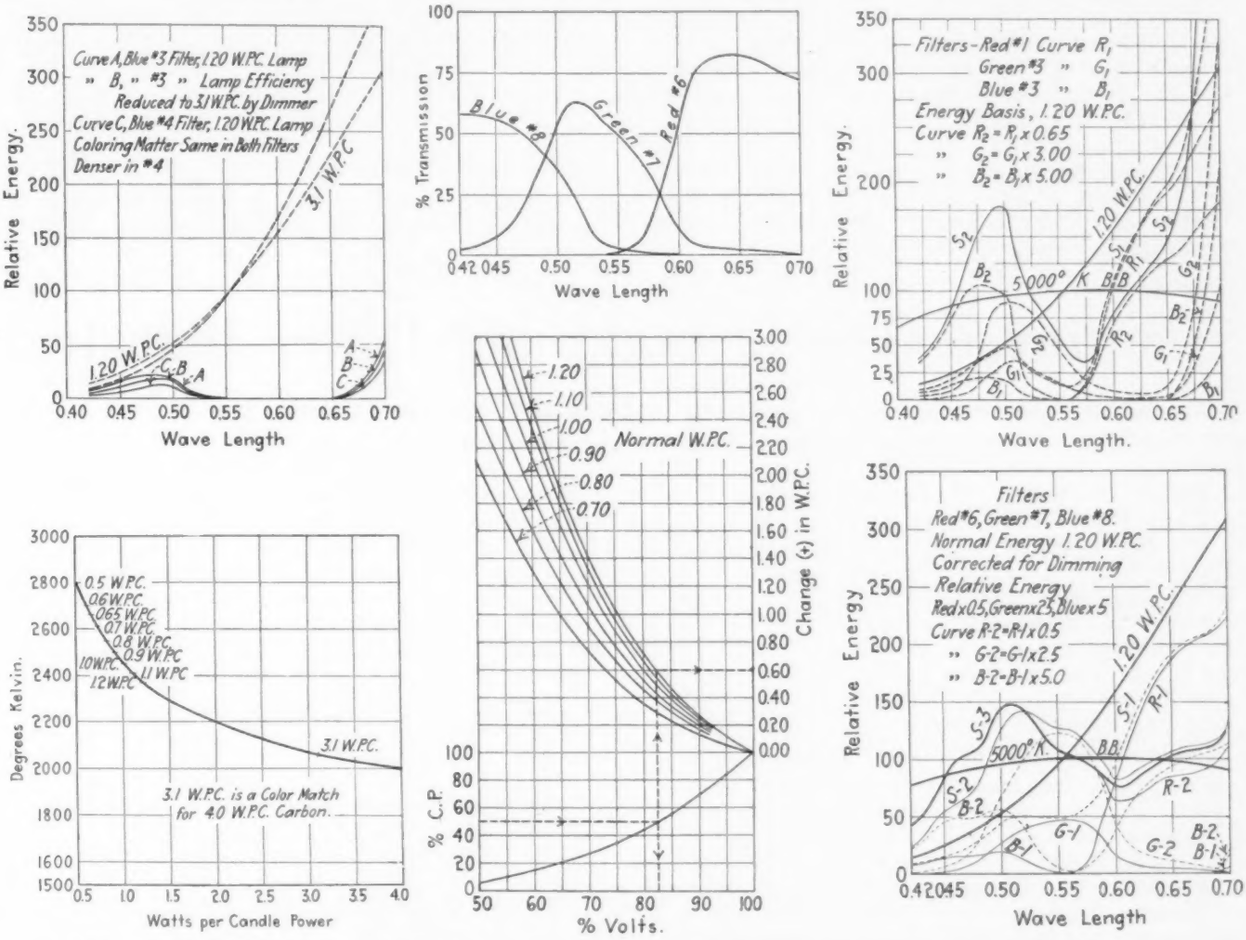
The per cent volts, the normal volts and the circuit resistance—lamp resistance + line resistance + dimmer resistance—will furnish data for the proper dimming equipment. Dimmers for tungsten lamps must have enough steps (at least 100) to obviate flicker as the voltage at the lamp changes in proportional increments.

From the increase in watts per candle determine the lamp efficiency in watts per candle at this "dim." Then refer to the temperature characteristic shown in Fig. 23 and so find the black-body temperature, at which the energy radiation is practically the same as the radiation from the tungsten filament at this efficiency. The approximate energy distribution can then be found from Fig. 26, and to this are to be applied the transmission coefficients of the color filter used.

All of this work is, of course, somewhat approximate, but will at least serve as a preliminary and very helpful guide in laying out stage-lighting equipments.

The result of applying all of these corrections to lamps operating normally at 1.20 watts per candle, the dimmer adjustments being such as to produce synthetic white, is shown in Fig. 25. The corrected color filters Nos. 6, 7 and 8 are used. The light flux transmitted by the filters is in the proportion 0.5, 2.5 and 5.0 for red, green and blue components respectively.

It should be noted that the curves of energy for the black-body radiation at various temperatures, given in Fig. 26, are so drawn as to cross, not at the usual arbi-



FIGS. 20 TO 22 (TOP ROW) AND 23 TO 25 (BOTTOM ROW)—TRANSMISSION COEFFICIENTS AND ENERGY-DISTRIBUTION CURVES FOR VARIOUS COLOR FILTERS

trary position, $\lambda = 0.590\ \mu$, but at $\lambda = 0.554\ \mu$, which is the mean position of maximum spectral luminosity as determined by Ives and Nutting. All the corresponding luminosity curves will therefore intersect at this same point and will be directly comparable.

It is not possible at this time to give characteristics similar to Figs. 23 and 24 for gas-filled lamps. The efficiency of these lamps is largely a matter of filament diameter and varies widely with the diameter at any given temperature. The efficiency of the gas-filled lamp is lower than that of the evacuated lamp at the same temperature. The energy characteristic of its radiation will therefore correspond to the black-body radiation at a lower temperature than in the case of the evacuated lamp at the same efficiency. The gas-filled lamp gets its high normal efficiency owing to the fact that it operates at a temperature much higher than is possible with the evacuated lamp.

The writer has, however, used the curves of Fig. 24 and a lower temperature characteristic than that shown on Fig. 23. If the results have been in error, the errors have not been noticeable. Energy distribution curves for the 0.65-watt-per-candle gas-filled lamp and for two or three other sources have been added to Fig. 26 for comparison. The black-body radiation was calculated by means of Wien's formula.

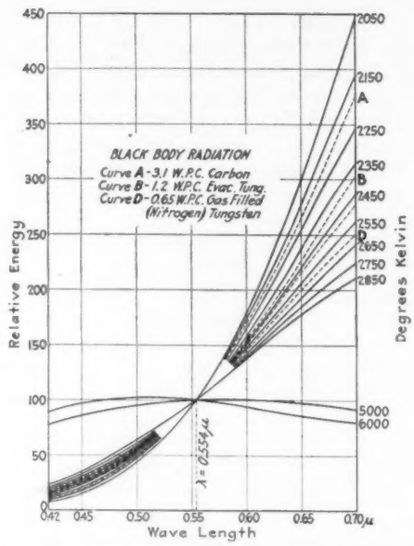


FIG. 26—COMPARATIVE ENERGY-DISTRIBUTION CURVES

It is perhaps well to state in closing that all of the devices and methods described have been protected by patents issued or pending.

Continued Gain in Light and Power Industry

Operations for Second Quarter of Calendar Year Show Marked Advance Over Those Recorded for the Two Previous Quarters

THE results of the June operations of electric light and power properties, according to the ELECTRICAL WORLD'S returns, show greater gains both in income and in output than those registered in any month since September. Indeed, the gain in output for June was the greatest in any month since the war began, although the gain in income was a trifle less in percentage than in either August or September last year. To this extent is reflected the growing improvement in the nation's industries.

Using the figures in Table I as a basis and computing

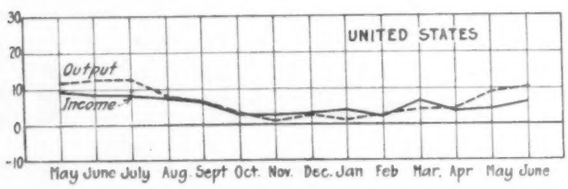


FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

therefrom the monthly totals for 100 per cent of the industry, it was found that for the twelve months ended April 30, 1915, the gain in gross income was 5.5 per cent and the increase in output 6 per cent. For the twelve months ended May 31, 1915, the gain in income was 5.4 per cent and the increase in output 5.8 per cent. For the twelve months ended June 30, 1915, the gain in income was 5.2 per cent and the increase in output 5.5 per cent. The reason for this slight drop in percentage growth is because each of the succeeding periods has had one month less of normal time and has had included one more month of war-time conditions than preceding periods.

During the last half of 1914 the average rate of growth was 5.3 per cent in gross income and the increase in output 5.7 per cent. For the first half of 1915 the average growth percentages were 4.8 in income and 5.3 in output. The average rate of growth during the third and fourth quarters of 1914 and the first and second quarters of 1915 respectively were as follows: Gross income, 7.8 per cent, 3.1 per cent, 4.1 per cent and 5.4 per cent; output, 9.3 per cent, 2.6 per cent, 2.8 per cent and 8 per cent. The results of the operations

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cen Increase
1914 July..	50	$14,086,822	$12,970,325	8.5	735,937,850	649,720,026	13.3
Aug..	51	15,298,226	14,200,649	7.8	778,109,565	718,274,456	8.2
Sept..	51	15,708,695	14,694,205	7.0	782,450,267	733,754,420	6.8
Oct..	59	17,667,912	17,174,567	2.8	969,817,024	935,249,519	3.0
Nov..	65	19,777,650	19,260,451	2.7	986,456,324	978,934,946	0.8
Dec..	65	20,978,430	20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
1915		1915	1914		1915	1914	
Jan..	65	21,582,547	20,697,423	4.1	980,085,036	966,200,323	1.4
Feb..	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2
Mar..	64	18,654,443	17,529,054	6.4	939,117,179	896,903,968	4.8
April	65	18,396,812	17,667,176	4.2	900,071,122	858,815,644	4.8
May	64	17,446,688	16,581,173	5.2	914,092,058	837,857,311	9.0
June	61	15,946,564	14,922,909	6.9	843,997,177	764,691,627	10.3

for the second quarter of 1915 show a rate of growth slightly less than that for the third quarter of 1914, which included one normal month and the first two months of the war. These figures are, however, better than those for the entire period of eleven months covered by the war, which show a gain of 5.1 per cent in income and an increase of 4.8 per cent in output.

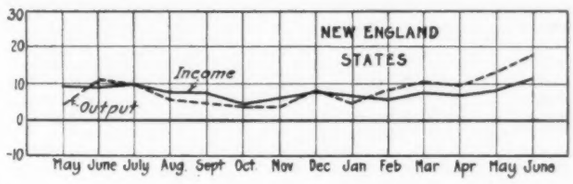
Using the average rate of growth for the months of

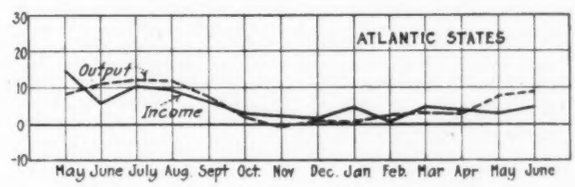
TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

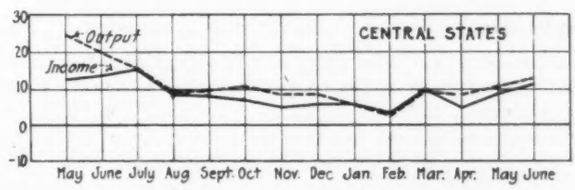
	Month	Percentage of Industry Represented	New England States 1914	New England States 1913	Per Cent Increase	Percentage of Industry Represented	Atlantic States 1914	Atlantic States 1913	Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded) 1914	Central States (Illinois Excluded) 1913	Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States 1914	Pacific and Mountain States 1913	Per Cent Increase
INCOME	July	60	1,670,819	1,530,410	9.2	54	6,152,169	5,583,309	10.2	52	3,802,126	3,307,719	15.0	72	2,212,827	2,068,249	6.8
	Aug.	61	1,734,583	1,607,649	7.5	55	6,224,896	5,755,515	8.2	57	4,389,696	4,051,678	8.4	75	2,386,677	2,282,061	4.6
	Sept.	61	1,766,587	1,647,945	7.3	55	6,608,221	6,221,000	6.1	57	4,704,780	4,368,251	7.9	75	2,487,513	2,398,176	3.7
	Oct.	64	1,963,579	1,889,255	4.0	67	7,451,220	7,232,063	3.1	57	5,105,810	4,783,847	6.8	85	3,146,160	3,157,689	0.3*
	Nov.	67	2,229,742	2,115,957	5.6	69	8,373,772	8,157,966	2.7	57	5,408,672	5,158,981	4.8	88	3,503,499	3,574,086	2.0*
	Dec.	67	2,385,711	2,218,387	7.5	69	8,765,275	8,594,773	2.2	57	5,992,542	5,654,740	5.9	88	3,834,902	3,813,912	0.3
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,960,608	3,917,371	1.0
	Feb.	67	2,246,794	2,134,341	5.4	69	8,037,878	7,968,625	0.9	55	5,296,786	5,148,439	3.0	85	3,576,432	3,534,864	1.2
	March	67	2,146,032	1,999,326	7.5	69	7,777,126	7,419,808	5.2	55	4,885,384	4,465,728	9.5	88	3,605,893	3,412,842	5.8
	April	67	2,109,767	1,976,473	6.8	69	7,510,810	7,241,164	3.9	57	4,994,073	4,765,341	4.8	88	3,475,740	3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	55	4,749,444	4,394,445	8.1	88	3,383,749	3,233,989	4.8
	June	65	1,864,112	1,679,393	11.1	68	6,835,718	6,522,643	4.8	52	4,160,915	3,730,813	11.5	79	2,894,760	2,791,010	3.8
KW.-HR. OUTPUT	July	60	54,074,533	49,255,893	9.8	54	263,580,290	235,068,939	11.8	52	217,928,950	188,569,581	15.6	72	183,160,015	169,718,387	7.9
	Aug.	61	55,801,224	52,913,483	5.4	55	264,717,319	237,984,895	11.2	57	267,501,400	226,276,638	9.4	75	193,216,699	185,330,705	4.2
	Sept.	61	55,525,272	53,267,877	4.3	55	270,974,533	252,648,550	7.3	57	260,705,339	237,832,934	9.7	75	190,979,705	185,090,658	3.2
	Oct.	64	67,520,070	65,068,938	3.8	67	358,458,539	351,362,247	2.1	57	295,490,712	266,827,567	10.5	85	245,966,868	252,047,828	2.4*
	Nov.	67	69,480,163	66,988,456	3.8	69	361,364,405	364,155,759	0.7*	57	290,681,750	269,220,528	8.0	88	255,651,947	269,467,354	5.1*
	Dec.	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	252,531,483	256,198,272	1.4*
	Feb.	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229,185,967	0.3
	March	67	72,121,319	65,343,335	10.5	69	346,341,496	335,506,429	3.3	55	257,136,231	235,656,647	9.2	88	255,529,704	253,423,951	1.0
	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,502,534	237,252,826	8.5	88	246,287,981	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	55	256,081,777	231,625,192	10.6	88	254,586,394	236,082,868	7.8
	June	65	66,115,454	56,067,278	17.9	68	313,336,991	288,588,840	8.7	52	234,175,960	207,085,923	13.2	79	222,127,107	203,510,333	9.1

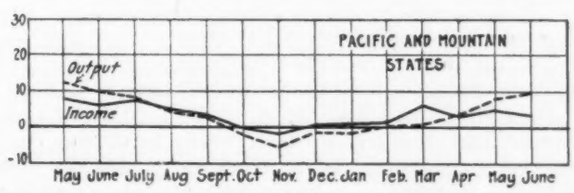
*Decrease

May, June and July, 1914, over the corresponding months of 1913, as the average growth that could be expected throughout the succeeding months had war been averted and times continued to be normal, and comparing these figures with the average rate of growth during the first eleven months of the war, the loss to the light and power industry due to the war up to June 30, 1915, is estimated to have been $11,500,000, which is at the average rate of a little over $1,000,000 per month. It must not be thought that this loss represents an actual loss over the previous year, for as a matter of fact there was an actual gain in gross income. It means that had the companies been operating under normal conditions such as existed throughout May, June and July, 1914, the gross earnings during the eleven following months would probably have been $11,500,000 more than they actually were.









FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

Chief Gain in the Large Cities

The principal gain in June was made in the large cities, those whose population is over 100,000. Companies operating in cities having a population of from 50,000 to 100,000 showed in every section of the country practically the same rate of growth in June as they did in May. With the exception of companies operating in towns with populations between 5000 and 10,000, the June results for cities under 50,000 were better than those for previous months.

Attention is called to the data shown in Table II for the New England States. Not only are the results far ahead of last year, but the rate of growth is greatly in excess of that registered during months of normal activity. The largest previous growth in income was 9.2 per cent in July, 1914. The growth in income for June, 1915, was 11.1 per cent. The largest previous growth in output, excepting the 12.9 per cent registered in May, 1915, was 11.1 per cent in June, 1914. The June, 1915, growth was 17.9 per cent. The operations in the Atlantic States continue to show an increase in rate of growth, but are still far from the large growth percentages shown in the months previous to the war.

In the Central States the results of June's operations were approximately equal in growth to those in normal times. The 11.5 per cent growth in income compares favorably with 12.7 per cent in May, 1914, 13.2 per cent in June, 1914, and 15 per cent in July, 1914; while the 13.2 per cent growth in output compares favorably with 15.6 per cent in July, 1914, although there is still

a long way to go to equal the figures of 19.4 per cent for June, 1914, and 24.8 per cent for May, 1914.

The returns for the Pacific and Mountain States show a normal rate of growth in output, namely, 9.1 per cent. This compares favorably with 11.9 per cent for May, 1914; 9.6 per cent for June, 1914, and 7.9 per cent for July, 1914. A slight reversion, however, is shown in the matter of income rate of growth, this being 1 per cent less for June than for May. The figures, 3.8 per cent, however, are decidedly better than the figures shown during the early months of the war and are not very far from the rates of growth shown in the months previous to the war.

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
INCOME:									
Group 1....	4.2	2.6	.6	2.7	2.0	8.0	3.8	4.8	6.1
Group 2....	4.7	4.7	.9	8.8	3.7	6.9	5.0	6.2	6.9
Group 3....	1.2	0.5	3.3	2.4	2.5	5.2	5.5	5.8	10.0
Group 4....	15.1	4.8	4.8	5.8	6.8	5.0	3.9	7.1	8.7
Group 5....	3.5	1.5	3.2	4.5	0.9	1.6*	1.9	5.5	4.9
OUTPUT:									
Group 1....	3.2	0.5	3.1	3.9	2.8	5.7	5.4	7.2	9.5
Group 2....	5.2	4.2	3.0	4.3	5.7	7.9	11.2	13.1	13.6
Group 3....	4.6*	7.2*	6.8	1.2	3.9*	3.6*	1.2*	6.1	11.2
Group 4....	6.3	5.7	9.2	9.0	5.5	3.2	3.0	29.1	9.8
Group 5....	2.9	2.6*	1.8	7.5	15.0	7.0	5.9	15.5	15.4

*Decrease.

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
INCOME:									
Group 1....	5.0	6.1	7.9	7.1	5.7	6.6	6.3	9.4	11.6
Group 2....	2.3	2.3	5.5	6.2	4.1	9.0	4.04	7.5	8.2
Group 3....	6.1	9.7	11.4	7.5	0.7	7.8	20.6	8.9	21.8
Group 4....	5.8	9.0	8.2	8.9	9.4	6.5	8.4	7.1	11.6
Group 5....	8.0	3.9	5.5	2.1*	1.9	14.7*	0.4*	1.0*	3.3*
OUTPUT:									
Group 1....	4.2	6.9	12.5	6.3	11.1	12.0	12.7	16.0	19.0
Group 2....	1.0	1.5*	5.9	5.4	6.4	12.3	12.3	19.9	21.4
Group 3....	6.6	7.5	11.0	1.2	3.6*	0.3*	3.2	7.0	17.9
Group 4....	14.2	4.2	12.5	10.9*	9.4	12.5	12.1	6.3	16.8
Group 5....	8.1*	8.3*	4.1	9.0*	6.1	29.8*	25.5*	13.5*	0.8

*Decrease.

Practically all sections of the country report large increases in industrial load. In New England the increased activity of factories engaged in the manufacture of war supplies accounts largely for the increased energy demand. Mining activities have had a large boom, particularly coal and zinc. In some regions in the Middle West companies have had largely to increase their equipment in order to handle the mining load. In the Northwest there is a continued depression due to the lumber industry. In the South the brightening of the cotton situation has been beneficial. Renewed prosperity in the iron and steel industry, which is now working up to 90 per cent of its capacity, has been responsible for large increases in energy demand. The jitney invasion, rate reductions, competition in some parts and the new low-energy-consumption lighting unit were given as reasons by some companies for not showing larger rates of growth, or, as happened in a few cases, for showing a decrease over the previous year.

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
INCOME:									
Group 1....	6.2	3.0	1.6	1.3	1.3	4.7	1.6	2.0	3.8
Group 2....	7.1	2.7	3.9	5.0	4.2	7.1	5.6	8.2	8.0
Group 3....	1.4	0.3*	0.4	3.3	3.6	3.8	4.1	1.6	7.5
Group 4....	6.8	4.8	7.9	4.9	10.1	6.8	2.9	6.2	8.0
Group 5....	10.2	13.5	11.2	9.0	†	†	15.2	19.6	14.8
OUTPUT:									
Group 1....	4.6	0.0	3.2	1.7	3.0	6.1	4.8	9.0	8.2
Group 2....	10.3	5.0	4.3	3.1	7.0	9.7	7.6	7.1	11.0
Group 3....	6.0*	8.5*	7.7*	7.4	2.7*	8.5*	4.1*	3.2	7.2
Group 4....	0.0	3.8	6.2	7.8	6.3	10.2	1.9	22.5	14.5
Group 5....	46.5	57.5	11.1	13.5	†	†	57.2	71.5	61.8

*Decrease.
†Results omitted owing to insufficient returns.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
INCOME:									
Group 1....	7.0	4.7	5.2	6.1	3.5	10.1	7.3	9.8	11.8
Group 2....	4.7	5.2	7.5	4.3	1.4	5.9	3.5	3.0	4.0
Group 3....	4.0	4.0	7.5	2.1	6.2	11.3	10.4	15.5	19.6
Group 4....	8.1	4.3	6.4	3.6	6.0	8.3	6.0	6.7	13.4
Group 5....	1.6	0.5*	1.5*	3.7	2.8	7.7	7.6	19.9	10.8
OUTPUT:									
Group 1....	6.3	2.4	4.2	9.0	4.7	7.7	6.8	8.4	9.8
Group 2....	11.2	14.8	12.4	4.8	1.2	8.0	12.5	9.7	13 0
Group 3....	5.0	6.6	12.4	8.2	6.2	14.7	13.1	27.0	26.1
Group 4....	7.8	8.3	13.3	8.4	10.0	12.8	7.9	10.0	15.5
Group 5....	5.0	4.9	13.0	13.7	18.3	13.5	39.7	28.8	30.1

*Decrease.

The accompanying curves show graphically the percentages of growth given in Tables I and II. The groups in the remaining tables refer to companies operating in cities of different size. Group 1 refers to companies in cities having a population of over 100,000; group 2, to those in cities having a population of between 50,000 and 100,000; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5000 and 10,000.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
INCOME:									
Group 1....	0.3*	2.4*	0.6*	1.0*	0.4	8.1	4.0	3.1	3.9
Group 2....	2.0	1.1	1.0	4.9	8.0	7.5	9.4	12.7	11.1
Group 3....	1.7*	3.5*	1.0	0.6	2.6*	1.0*	0.3*	3.4	3.6
Group 4....	2.9*	1.4	6.5	6.2	0.6	2.6*	3.8*	8.7	4.6*
Group 5....	0.1	3.1*	2.5*	1.8	2.0*	3.5*	2.7*	2.4*	3.3
OUTPUT:									
Group 1....	1.6*	2.1*	0.0	1.5	0.5*	2.5	4.5	2.3	9.3
Group 2....	13.0*	7.7*	13.0*	7.2*	13.5	3.0	11.6	19.0	14.9
Group 3....	7.3*	14.1*	14.2*	13.5*	11.5*	4.0*	3.5*	3.8	12.4
Group 4....	7.1	4.4	3.7	9.5	0.6*	9.5*	4.7*	87.0	10.1*
Group 5....	1.1	2.9*	1.0	4.1	9.9	18.0	9.6	18.5	3.6

*Decrease.

Quick-Reference Directory for Emergency Calls

A quick-reference directory, containing the names, addresses and telephone numbers of department heads, inspectors, foremen, chauffeurs, doctors, hospitals, police stations and the like, is posted in the general office of the Consolidated Gas, Electric Light & Power Company of Baltimore in order to facilitate the establishing of immediate communication in emergencies. This directory is of particular value when an accident happens to any part of the electrical system at night when most of the chief employees are at home. The list of names is subdivided according to departments and classified alphabetically. Each name is printed on a separate strip which can be replaced by another when changes are made. A large sign over the directory reads: "For Emergency Calls—Addresses and Telephone Numbers."

The Design of Stationary Transformers

An Analysis of Various Methods of Procedure in the Design of Static Transformers and Suggestion for Their Simplification

BY SEWALL CABOT AND C. F. CAIRNS

DURING the past four years the following six books have been published dealing with a specific method of procedure in the design of alternating-current static transformers: (1) Bohle and Robertson, "Treatise on Transformers," 1911; (2) Hobart, "Design of Static Transformers," 1911; (3) Ryan, "Design of Electrical Machinery," 1912; (4) Barr and Archibald, "Alternating-Current Machinery," 1913; (5) A. Gray, "Electrical Machine Design," 1913; (6) Pender, "American Handbook for Electrical Engineers," 1914.

On analyzing the methods advocated in these books it will be seen that there are in reality two distinct methods advocated.

Method I—Bohle and Robertson

The fundamental general equations of the transformer are differentiated and a set of tables and curves deduced from which it is possible to make a preliminary design, assuming the kva., core loss, copper loss, quality of the

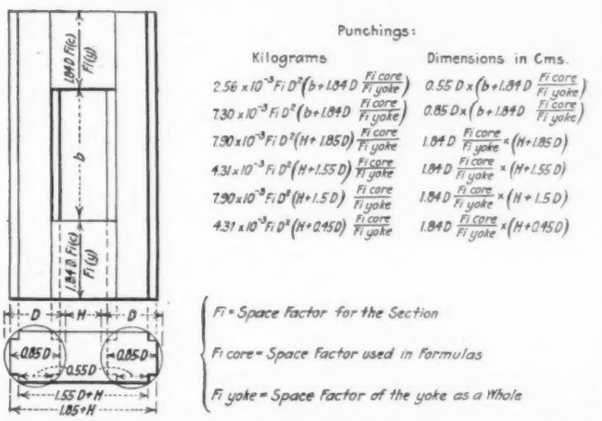

1.84 D Fi(c)
Fi(y)
b
1.84 D Fi(c)
Fi(y)
D
H
D
0.85D
0.85D
0.55D
1.55 D+H
1.85+H
Punchings:
Kilograms
Dimensions in Cms.
2.56 x 10⁻³ Fi D² (b+1.84 D Fi core/Fi yoke)
0.55 D x (b+1.84 D Fi core/Fi yoke)
7.30 x 10⁻³ Fi D² (b+1.84 D Fi core/Fi yoke)
0.85 D x (b+1.84 D Fi core/Fi yoke)
7.90 x 10⁻³ Fi D² (H+1.85 D) Fi core/Fi yoke
1.84 D Fi core/Fi yoke x (H+1.85 D)
4.31 x 10⁻³ Fi D² (H+1.55 D) Fi core/Fi yoke
1.84 D Fi core/Fi yoke x (H+1.55 D)
7.90 x 10⁻³ Fi D² (H+1.5 D) Fi core/Fi yoke
1.84 D Fi core/Fi yoke x (H+1.5 D)
4.31 x 10⁻³ Fi D² (H+0.45 D) Fi core/Fi yoke
1.84 D Fi core/Fi yoke x (H+0.45 D)
Fi = Space Factor for the Section
Fi core = Space Factor used in Formulas
Fi yoke = Space Factor of the yoke as a Whole

FIG. 1—CIRCULAR-CORE TYPE, AREA OF CORES ONE-HALF AREA OF YOKES

iron, temperature of the copper, space factor of the winding, space factor of the iron, and ratio of cost per unit volume of copper space to cost per unit volume of iron space, this preliminary design giving a transformer which will cost the least money to build under the conditions assumed.

If the assumed ratio of core loss to kva. is too great for the volume of iron calculated, the temperature of the iron will be too great or the magnetizing current will be too great.

To correct this it will be necessary to redesign the transformer, assuming a less core loss.

Method 2—H. M. Hobart

The preliminary assumptions made are the kva., copper loss, iron loss, quality of the iron, temperature of the copper, and space factor of the iron, and in addition the assumptions, deduced from commercial practice and set forth in the form of curves and tables, comprising volts per turn, widths of window, maximum flux density and space factor of copper.

Using these preliminary assumptions in a set of simple and well-recognized algebraic formulas, the designer can lay out a preliminary design which must later be recalculated and slightly revised, since all of the preliminary assumptions made are not compatible with each other.

With this method there is no means of knowing whether the geometrical shape finally deduced is that which fulfills the specification for a minimum cost.

Ryan advocates Method 2, except that he makes no preliminary assumption of copper space factor and width of window, but he does make a vague assumption of geometrical shape substantially as shown in a set of cuts.

Barr and Archibald advocate what amounts to Method 1, but instead of giving tables and curves they endeavor to deduce the general formula for calculating each case. They neglect to use calculus at one step, but instead use a very laborious graphical solution. They also make the mistake of assuming that the cheapest transformer is obtained when the costs of active iron and copper are equal. That this is a fallacy is shown by Bohle and Robertson (page 561). Values given by their equations are for this reason slightly incorrect.

Gray advocates Method 2 except that he makes no preliminary assumption of the copper loss. Slichter, in the "American Handbook for Electrical Engineers," advocates Method 2, except that he makes a further preliminary assumption of current density and ampere turns per inch of core.

Comparing Method 1 with Method 2, it is the opinion of the writers that Method 1 should be superior if the data were correctly set forth in a form easily understandable by the designer, since Method 1 proceeds from a minimum of preliminary assumptions directly to all dimensions and data by one set of calculations and arrives at a construction involving a minimum of cost to fulfill the preliminary assumptions. In Method 2 recalculations are usually necessary, and when the final result is reached the geometrical shape will not in general be that which gives the least cost, although it may not be far from the most economical design.

The writers have also come to the conclusion that, taking all things into consideration, the core type of transformer with circular coils is perhaps a more promising construction for fulfilling a given set of specifications for a single-phase transformer than a core type of transformer having rectangular or square coils. They are led to this conclusion from the following considerations:

First—The circulation of oil through the ducts and over the winding surfaces is the least restricted in this type.

Second—In this type the density of the leakage flux is smallest, and hence the eddy losses in the copper are a minimum.

Third—The labor of winding a circular coil is less, the space factor slightly better, and the ability to withstand mechanical strains slightly better, than for a rectangular or square coil.

The writers have differentiated the fundamental equations of this transformer and plotted the results graphically (see Fig. 3).

Although a different mathematical process and method of reasoning from that employed by Bohle and Robertson were used to obtain these results, nevertheless it will be found on analysis that they check the results of Bohle and Robertson, given in Chapter X of their book.

Inspection of these graphical results shows that the

geometrical shape giving the smallest cost of active material changes with the product of the two ratios, cost of active iron per kilogram to cost of active copper per kilogram, and space factor of iron to space factor of copper.

In the practical construction of transformers there is not very much change in the product of these ratios for the reason that as the space factor of copper decreases, owing to increased voltage requirements, the cost of insulating material and labor which may be properly associated with each kilogram of copper increases. The resultant value of this ratio is roughly 1 to 2. Adopting that geometrical shape for all transformers which gives the least cost for this ratio equal to 0.5, the increase in cost for values of the ratio anywhere between 0.25 and 1 will be negligible, being less than 2 per cent at the extreme limits mentioned. The percentage increase is shown by a curve on Fig. 3.

Procedure in Preliminary Design

The values of the following quantities are assumed:

Rated output in volt-amperes $= W$.

Core loss in watts $= P_i$.

Copper loss in watts $= P_c$.

Frequency in cycles $= f$.

High-tension and low-tension voltages.

1. From a curve showing at different flux densities the watts lost per unit of mass of the iron to be used, calculate the value of the iron constant

$$C_i = \frac{\text{watts per kg.}}{(\text{lines per sq. cm.})^2},$$

taking the data from curve at the flux density of, say, 12,000 lines per sq. cm.

2. Decide on the temperature at which the transformer is to fulfill the specifications. The value of the copper constant

$$C_c = \frac{\text{watts per kg.}}{(\text{amp. per sq. cm.})^2}$$

will then be as follows:

At 20 deg. C., $C_c = 2.125 \times 10^{-4}$.
At 30 deg. C., $C_c = 2.210 \times 10^{-4}$.
At 40 deg. C., $C_c = 2.295 \times 10^{-4}$.
At 50 deg. C., $C_c = 2.380 \times 10^{-4}$.
At 60 deg. C., $C_c = 2.480 \times 10^{-4}$.

These values include a 10 per cent allowance for eddy currents in copper.

3. Decide on the values to assign to the iron and copper space factors F_i and F_c. These may be obtained from books dealing with the design of transformers, or, better, from commercial designs of transformers of similar specifications. In general, the iron space factor with one step cruciforming of the core will be 0.7 without ducts and 0.65 with ducts. Copper space factors in transformers under 7000 volts will be roughly 0.4, ranging from 0.3 in small transformers to 0.55 in transformers having low voltages and high efficiencies.

4. Calculate the value of the quantity

$$L = \frac{1.6 \times 10^6 W}{f} \sqrt{\frac{C_i \times C_c}{P_i \times P_c \times F_i \times F_c}}.$$

5. The maximum flux density in lines per square centimeter may now be calculated by the formula

$$B_m = 2.6 \sqrt{\frac{P_i}{C_i F_i L^2}}.$$

If the specified efficiency is low in comparison with modern commercial requirements, this may give a value of maximum flux density which would cause too great magnetizing currents in small transformers or too great a rate of heating in the iron of large transformers; 11,000 and 14,000 lines per sq. cm. are roughly the upper limits respectively for the two cases.

The same efficiency requirements may be met and the difficulty obviated by recalculating L, using a smaller value of P_i and a correspondingly greater value of P_c, such that $P_i + P_c$ is unchanged.

6. The current density in amperes per square centimeters is given by the formula:

$$Q = 2.6 \sqrt{\frac{P_c}{C_c F_c L^2}}.$$

7. The dimensions in centimeters of the transformer may now be calculated, viz.,

$D = 1.35L$.
$H = 0.948L$.
$b = 3.01L$.

The volts per turn will be $6.33 \times 10^{-8} f B_m L^2 F_i$.

The weight of iron in kilograms will be $K_i = 0.147 F_i L^3$.

The weight of copper in kilograms will be $K_c = 0.147 F_c L^3$.

The final design of the transformer will then consist in choosing stock sizes of copper which come nearest to the figures of the preliminary design. The winding layout is then made, modifying the dimensions of the winding space arrived at in the preliminary design as little as feasible. The core dimensions are finally slightly modified to fit the actual layout of the winding space.

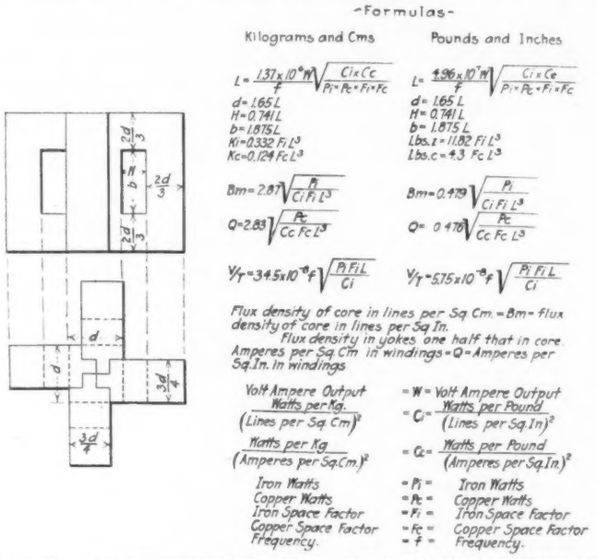

-Formulas-
Kilograms and Cms
Pounds and Inches
d= 1.65 L
H= 0.741 L
b= 1.875 L
Ki=0.332 Fi L³
Kc=0.124 Fc L³
Lbs.i = 11.82 Fi L³
Lbs.c = 4.3 Fc L³
Flux density of core in lines per Sq Cm = Bm = flux density of core in lines per Sq In.
Flux density in yokes one half that in core.
Amperes per Sq Cm in windings = Q = Amperes per Sq In. in windings
Volt Ampere Output = W = Volt Ampere Output
Watts per Kg. = Ci = Watts per Pound
(Lines per Sq Cm)² (Lines per Sq In)²
Watts per Kg = Cc = Watts per Pound
(Amperes per Sq Cm)² (Amperes per Sq In)²
Iron Watts = Pi = Iron Watts
Copper Watts = Pc = Copper Watts
Iron Space Factor = Fi = Iron Space Factor
Copper Space Factor = Fc = Copper Space Factor
Frequency. = f = Frequency.

FIG. 2—DISTRIBUTED-CORE TYPE, AREA OF CORE ONE-HALF AREA OF YOKES

Improved Design; Yoke with Double the Area of Core

The foregoing formulas are deduced on the assumption that the iron in the yokes is run at the same flux density as the iron in the cores. If the net area of the yokes is doubled, it is possible to save roughly 15 per cent in the cost of active material to fulfill a definite specification of efficiency.

Fig. 2 shows the geometrical shape of a transformer designed on this principle.

The method of design is exactly as above outlined except that the coefficients in the formulas are as follows:

$$L = \frac{1.41 \times 10^6 W}{f} \sqrt{\frac{C_i \times C_c}{P_i \times P_c \times F_i \times F_c}}.$$

$D = 1.35L$.
$H = 0.948L$.
$b = 3.01L$.

$$B_m = 2.94 \sqrt{\frac{P_i}{C_i F_i L^2}}. \quad \text{(Flux density in cores.)}$$

$$Q = 2.6 \sqrt{\frac{P_c}{C_c F_c L^2}}.$$

$V/T = 6.33 \times 10^{-4} f B_m L^2 F_i$. ($B_m$ = flux density in cores.)

$K_i = 0.228 F_i L^2$.

$K_c = 0.147 F_c L^2$.

Since many designers prefer to work in inches and pounds, rather than in centimeters and kilograms, the necessary changes to convert the formulas for Fig. 2 to the inch-pound system are as follows:

$$L' = \frac{5.11 \times 10^7 W}{f} \sqrt{\frac{C_i' \times C_c'}{P_i \times P_c \times F_i \times F_c}}.$$

$D' = 1.35L'$.

$H' = 0.948L'$.

$b' = 3.01L'$.

$$B_m' = 0.492 \sqrt{\frac{P_i}{C_i F_i L'^n}}.$$

$$Q' = 0.432 \sqrt{\frac{P_c}{C_c F_c L'^n}}.$$

$V/T' = 6.33 \times 10^{-4} f F_i L'^n B_m$.

$\text{Lbs}_i = 8.15 F_i L'^3$.

$\text{Lbs}_c = 5.25 F_c L'^3$.

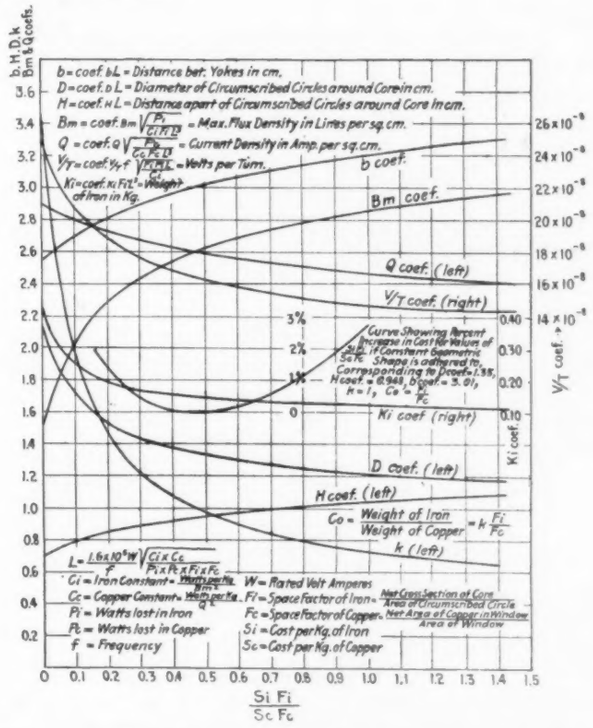

b, H, D, k Bm & Q coefs.
b = coef. bL = Distance bet. Yokes in cm.
D = coef. b L = Diameter of Circumscribed Circles around Core in cm.
H = coef. H L = Distance apart of Circumscribed Circles around Core in cm.
Bm = coef. Bm √(Pi / Ci Fi L'^n) = Max. Flux Density in Lines per sq. cm.
Q = coef. Q √(Pc / Cc Fc L'^n) = Current Density in Amp. per sq. cm.
V/T = coef. ½ f √(Fi Pi L' / Ci) = Volts per Turn.
Ki = coef. ki Fi L'^n = Weight of Iron in Kg.
b coef.
Bm coef.
Q coef. (left)
V/T coef. (right)
Curve Showing Percent Increase in Cost for Values of Si Fi / Sc Fc if Constant Geometric Shape is adhered to Corresponding to Coefs. 1.35, H coef. = 0.948, b coef. = 3.01, H = 1, Co = Fi / Fc
Ki coef. (right)
D coef. (left)
H coef. (left)
Co = Weight of Iron / Weight of Copper = k Fi / Fc
k (left)
L = 1.6 x 10^8 W √(Ci x Cc / Pi x Pc x Fi x Fc)
Ci = Iron Constant = Watts per lb. / (lines per sq. in.)^2
Cc = Copper Constant = Watts per lb. / (amp. per sq. in.)^2
Pi = Watts lost in Iron
Pc = Watts lost in Copper
f = Frequency
W = Rated Volt Amperes
Fi = Space Factor of Iron = Net Cross Section of Core / Area of Circumscribed Circle
Fc = Space Factor of Copper = Net Area of Copper in Window / Area of Window
Si = Cost per Kg. of Iron
Sc = Cost per Kg. of Copper
Si Fi / Sc Fc

FIG. 3—CIRCULAR-COIL TYPE OF TRANSFORMER—SINGLE-PHASE CURVES FOR CALCULATING IMPORTANT DATA OF CHEAPEST TRANSFORMER OF A SPECIFIED EFFICIENCY

$$C_i' = \frac{\text{watts per lb.}}{(\text{lines per sq. in.})^2} = 1.09 \times 10^{-3} C_i.$$

$$C_c' = \frac{\text{watts per lb.}}{(\text{amp. per sq. in.})^2} = 1.09 \times 10^{-3} C_c.$$

There does not seem to be any valid reason why transformers should not always be designed to have greater flux density in the cores than in the yokes. The change in the coefficient in the formula for L takes care of the increased value of the iron constant in the yokes, and also allows for a small amount of eddy-current loss in the lap joints. The flux density at the lap joints is only half that in the cores and thus reduces the magnetizing ampere-turns. The yokes are run at a flux density at which the iron has its greatest permeability, and this reduces still further the magnetizing currents. The energy loss in the yokes is relatively small, owing to the low flux density, and therefore a considerable portion of the heat generated in the cores is conducted to and radiates from the yokes.

The net result is that the cores may be run at a greater flux density, if desired, without producing excessive heating and too large a magnetizing current. The writers have not determined precisely the best ratio of core area to yoke area, but several attempts to ascertain the best value of this ratio indicate 0.5 to be approximately correct.

Comparison of Several Specific Designs

In order to test this method of design the writers have taken published designs from the books quoted and have analyzed them into essential factors given in the foregoing formulas. They have then in each case worked through two designs on the same specification, using the method above set forth, the first of the two designs being made without increasing the yoke area, in order to compare the cost of active material when the geometric shape was merely changed to that advocated, and the second design using the method advocated with double yoke area.

The results of this analysis are set forth in the table.

It will be noted that in the case of the designs without increased yoke area an appreciable saving in the cost of active material was effected in every case, with the one exception of the Bohle and Robertson design quoted, in which case the cost was the same. It is significant that this case is apparently the only one of the designs quoted in which pains were taken to ascertain accurately the correct geometrical shape.

It will be noted that the writers have chosen a slightly increased copper space factor when designing a circular coil transformer to meet the specifications of a rectangular coil transformer. The reason for this is that in the circular-coil type the space between the coil and core is charged against the iron space factor, instead of against the copper space factor, as is the case in the rectangular-coil type. Furthermore, better compression of the insulation may be secured with the circular winding.

Modifications in Above Methods

In case it is desired to use the geometric shape giving the least cost of active material for any specific value of $\frac{S_i F_i}{S_c F_c}$, the values of all the important data may be obtained from the curves of Fig. 3. These curves give data specifically for transformers having the same flux density throughout the cores and yokes.

In case it is decided to adopt the design shown in Fig. 2, where the flux density in the yoke is 0.5 that in the core, the following changes in the formulas are made:

$L' = 0.889L$.

$b' = \text{coef } bL'$.

$D' = \text{coef } DL'$.

$H' = \text{coef } HL'$.

$$B_m' = 1.125 \text{ coef } B_m \sqrt{\frac{P_i}{C_i F_i L'^n}}.$$ (Maximum flux density in cores.)

$$Q' = \text{coef } Q \sqrt{\frac{P_c}{C_c F_c L'^n}}.$$

$$V/T' = 1.125 \text{ coef } V/T \, f \sqrt{\frac{F_i P_i L'}{C_i}}.$$

$K_i' = 1.55 \text{ coef } K_i F_i L'^n$.

$k' = 1.55k$.

The procedure in design will be precisely similar to that above advocated, except that the coefficients for b, D, H, B_m, Q, V/T and K_i and k must be read from

the curves instead of taking a fixed numerical value corresponding to a fixed geometrical shape, as outlined above under procedure of design.

In designing transformers for central stations and power purposes, where a small core loss is not a positive asset (as in transformers for lighting distribution), it may pay to depart from the specific geometrical shape above advocated in certain cases. In this class of transformers the core and copper losses are usually specified to be equal, so as to give maximum efficiency at full rated load. If the efficiency requirements are not very high, it will be found that using the above recommended specific geometrical shape will give a flux density higher than permissible. Under these conditions the writers recommend the following procedure in design:

Let F = the flux density which is higher than permissible, let F' = the flux density which is as high as permissible, then coef $B_m = \frac{2.6F'}{F}$.

Refer to Fig. 3 and use geometrical shape which has this value of coefficient B_m, using the modified procedure of design above mentioned. This method insures the least departure from the geometric shape giving least cost, and overcomes the difficulty of too great flux density. It will be noted that changing the geometrical shape in this manner to overcome too great a flux density causes an increase in current density. With this type of transformer the copper is usually much further from its safe temperature rise than the iron. If the point is reached by changing the geometrical shape in this manner where both the iron and copper are running at their safe temperature, the transformer will cost the minimum amount for the given rating. The efficiency may be less than modern commercial requirements, yet in cases where the cost of radiating extra heat is low (as in the case of water cooling), it may prove desirable to employ this shape.

In case it is desired to apply the same method of design to the distributed core type of transformer, as shown in Fig. 4, choosing that fixed geometrical shape which best suits the average value of $\frac{S_iF_i}{S_cF_c}$, the formulas will be as shown in Fig. 4. The cost of active material is roughly 87 per cent of the improved circular-coil transformer and 72 per cent of the ordinary circular-coil transformer. It will be noted that with this type of transformer the efficiency must be slightly higher than with the circular-coil type of transformer in order to avoid running the iron and copper at too high a temperature. This increases the cost of active material per kilowatt. With this type of transformer the density of the leakage flux is somewhat greater, on account of the greater number of ampere-turns per unit length of core. These factors make it slightly more difficult to keep down either the cost of active material or the temperature of the winding.

The labor in constructing this type of transformer is somewhat greater than the circular-coil core type, and the space factor of the copper is slightly less. Whether or not this type is superior to the circular-coil type becomes largely a question of manufacturing facilities. Probably this type is better suited to smaller sizes and low potentials than it is to larger sizes and high potentials.

Three-Phase Transformers

Three-phase transformers of the circular-coil type may be designed by the same method as outlined for single-phase transformers. Fig. 4, like Fig. 3, shows the value of the various coefficients for use in the various formulas. These formulas are the same as those for single-phase transformers previously given except for the numerical values of the coefficients, which are given in Fig. 4. In case it is desired to use yokes with double the area of the core, the necessary changes in the formulas are as follows:

Multiply coef L by 0.889.
Multiply coef B_m by 1.135.
Multiply coef K by 1.54.
Multiply coef k by 1.54.
Multiply coef v/t by 1.135.

The example below shows the application of the method to the design of a three-phase transformer, the curves given in Fig. 4 being used to arrive at the best geometrical shape with a given specified value of $\frac{S_iF_i}{S_cF_c}$. The specifications and assumptions were taken from a transformer outlined in Barr and Archibald's "Alternating-Current Machinery," page 188.

SPECIFICATIONS AND ASSUMPTIONS

Rated output, 90,000 volt-amp.; space factor of iron, $F_i = 0.712$.
Core loss, 1100 watts; space factor of copper, $F_c = 0.573$.
Copper loss, 1200 watts; cost of iron per kg., $S_i = \$0.206$.
Frequency, 18 cycles; cost of copper per kg., $S_c = \$0.30$.
High-tension voltage, 2200 volts; iron constant,, $C_i = 1.205 \times 10^{-8}$.
Low-tension voltage, 130 volts; iron constant, $C_c = 2.18 \times 10^{-8}$.

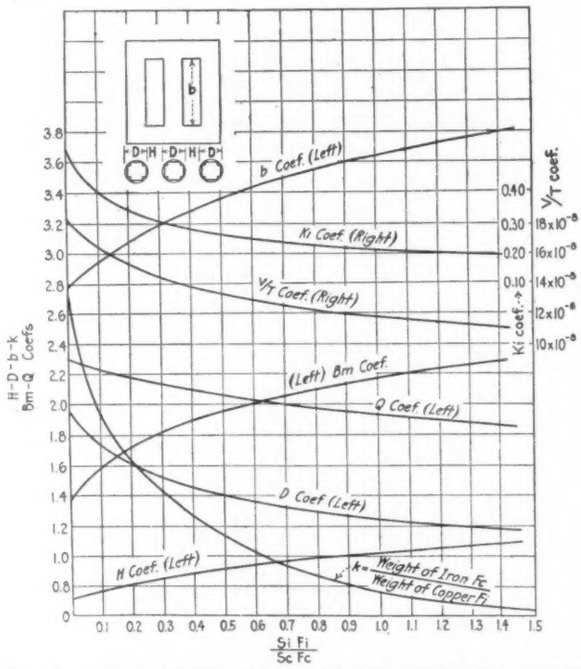


FIG. 4—CIRCULAR-COIL TYPE OF TRANSFORMER—CURVES FOR CALCULATING IMPORTANT DATA OF CHEAPEST TRANSFORMER OF A SPECIFIED EFFICIENCY

The value of $\frac{S_iF_i}{S_cF_c} = 0.885$.

The value of

$$L = \frac{1.6 \times 10^8 W}{f} \sqrt{\frac{C_i \times C_c}{P_i \times P_c \times F_i \times F_c}} = 17.68.$$

The first operation is to calculate the maximum flux density (B_m).

From the coef B_m curve in Fig. 4 at the value of $\frac{S_iF_i}{S_cF_c} = 0.855$, the coef B_m is 2.12, and

$$B_m = 2.12 \sqrt{\frac{P_i}{C_iF_iL^2}} = 10{,}200 \text{ lines per sq. cm.}$$

From the curve coef $Q = 1.96$, and

$$Q = 1.96 \sqrt{\frac{P_c}{C_cF_cL^2}} = 82 \text{ amp. per sq. cm.}$$

ANALYSIS OF PUBLISHED DESIGNS

	1			2			3			4			5			6		
	Barr and Archibald, Circular Coils	Circular Coils	Improved Circular Coils	Barr and Archibald, Rectangular Coils	Circular Coils	Improved Circular Coils	Bobie and Robertson, Rectangular Coils	Circular Coils	Improved Circular Coils	Gray, Rectangular Coils	Circular Coils	Improved Circular Coils	Hobart, Rectangular Coils	Circular Coils	Improved Circular Coils	Ryan, Rectangular Coils	Circular Coils	Improved Circular Coils
Kilowatt output	100	100	100	100	100	100	100	100	100	15	15	15	20	20	20	15	15	15
Frequency	50∞	50∞	50∞	50∞	50∞	50∞	50∞	50∞	50∞	60∞	60∞	60∞	50∞	50∞	50∞	60∞	60∞	60∞
Efficiency	98.23%	98.23%	98.23%	98.22%	98.22%	98.22%	98.23%	98.23%	98.23%	97.94%	97.94%	97.94%	97.3%	97.3%	97.3%	96.96%	96.96%	96.96%
Low-tension voltage	400	400	400	2200	2200	2200	2200	2200	2200	220	220	220	200	200	200	440	440	440
High-tension voltage	2000	2000	2000	6000	6000	6000	6000	6000	6000	2200	2200	2200	4000	4000	4000	4400	4400	4400
Core loss	900	900	680	965	905	905	900	900	675	99	99	99	190	190	190	185	185	185
Copper loss	900	900	1120	845	905	905	900	900	1125	217	217	217	365	365	365	285	285	285
Iron space factor	0.7	0.7	0.7	0.82	0.7	0.65	0.8	0.65	0.65	0.9	0.7	0.7	0.94	0.7	0.65	0.88	0.7	0.65
Copper space factor	0.425	0.425	0.425	0.305	0.4	0.4	0.34	0.4	0.4	0.523	0.55	0.523	0.37	0.4	0.4	0.392	0.40	0.40
Weight of iron	380 kg.	328 kg.	383 kg.	475 kg.	356 kg.	392 kg.	288 kg.	311 kg.	368 kg.	50 kg.	82 kg.	92.8 kg.	76 kg.	95 kg.	104.5 kg.	0.65 kg.	70.4 kg.	77 kg.
Weight of copper	190 kg.	198.5 kg.	150 kg.	280 kg.	203 kg.	156 kg.	199 kg.	191.5 kg.	146.5 kg.	83.5 kg.	64.5 kg.	44.6 kg.	68 kg.	54.3 kg.	41.5 kg.	51 kg.	40.2 kg.	30.6 kg.
Flux density	11,150	12,100	13,600	9500	10,600	14,390	13,500	12,680	14,250	9850	7560	10,180	11,000	9850	13,350	9300	8920	12,150
Current density	130	129.5	166	133	139	160	133	136	174	110	120	151	150	174.5	200	164 ht. 135 lt.	181.5	206
Volts per turn	5.7	5.89	5.4	7.4	5.42	5.7	6.89	5.71	5.44	1.52	1.76	1.91	1.6	2.08	2.21	1.11	1.85	1.95
Height of window	51 cm.	44.2 cm.	40.3 cm.	42 cm.	45.5 cm.	42 cm.	40.1 cm.	44.5 cm.	40.9	29.8 cm.	28 cm.	25.4 cm.	51 cm.	29.3 cm.	27.1 cm.	21 cm.	26.5 cm.	24.4 cm.
Width of winding space	11.8 cm.	14 cm.	12.7 cm.	15.9 cm.	14.4 cm.	13.12 cm.	17.2 cm.	14.05 cm.	12.9 cm.	11.4 cm.	8.84 cm.	7.93 cm.	8.5 cm.	9.23 cm.	8.45 cm.	11.1 cm.	8.35 cm.	7.6 cm.
Width of iron	....	...	....	14 cm.	...	....	11.5 cm.	...	....	6.35 cm.	...	....	7 cm.	...	....	7.15 cm.	...	....
Depth of iron	....	...	....	31 cm.	...	....	25.5 cm.	...	....	10.15 cm.	...	....	10 cm.	...	....	14.3 cm.	...	....
Diameter of circumscribed circle	21 cm.	19.9 cm.	18.1 cm.	....	20.4 cm.	18.7 cm.	....	20 cm.	18.37 cm.	....	12.55 cm.	11.3 cm.	....	13.15 cm.	12.05 cm.	....	11.9 cm.	10.85 cm.
Ratio of costs	1	0.925	0.894	1	0.89	0.78	1	1	0.91	1	0.914	0.772	1	0.916	0.82	1	0.894	0.70

1. "Alternating-Current Machinery," Barr and Archibald, page 167.
2. "Alternating-Current Machinery," Barr and Archibald, page 179.
3. "Treatise on Transformers," Boble and Robertson, page 264.
4. "Electrical Machine Design," A. Gray, page 480.
5. "Design of Static Transformers," Hobart, page 89.
6. "Design of Electrical Machinery," Vol. II, Ryan, page 81.

The dimension coefficients from the curve are coef $D = 1.27$, coef $H = 1.00$, coef $b = 3.57$. The dimensions in centimeters are then:

$D = 1.27L = 22.4$ cm.; $H = 100L = 17.68$ cm.; $b = 3.57L = 63.1$ cm.

The volts per turn coef $= 12 \times 10^{-8}$, and therefore

$$V/T = 12 \times 10^{-8} f \sqrt{\frac{P_i F_i L}{C_i}} = 2.31.$$

The kilogram of iron coef $= 0.220$, and therefore $K_i = 0.220 F_i L^3 = 860$ kg.

The cost of iron $= 860 \times S_i = \$177$.

The value of k from curves is 0.83.

The kilograms of copper are equal to the kilograms of iron divided by $\frac{kF_i}{F_c} = 1.042$; that is, the kilograms of copper $= 825$ kg.

The cost of copper $= 825 S_c = \$249$.

The total cost of active material $= \$426$.

It will be noted that the cost of the active material for the design given by Barr and Archibald for these same specifications and assumptions is \$460. (There is an error in the copper space factor given by Barr and Archibald due to their using the distance between the cores instead of the distance between the circles circumscribing the cores. This error has been corrected in the example given above.)

Conclusions

1. It is possible that a specific geometrical shape may be adopted advantageously for the purpose of simplifying the process of the preliminary design in the case of the circular-coil core type of single-phase stationary alternating-current transformers.

2. It is possible that by using this method of design the cost of active material to fulfill a given set of specifications is not greater in the circular-coil core type than in the rectangular-core type.

3. The core type of transformer may always be advantageously designed to have a greater flux density in the core than in the yokes.

Vibration of Telephone Diaphragms

In a paper by Messrs. A. E. Kennelly and H. O. Taylor, entitled "Explorations Over the Vibrating Surfaces of Telephonic Diaphragms Under Simple Impressed Tones," read before the American Philosophical Society at Philadelphia recently, it was pointed out that hitherto measurements of the amplitude of vibration of a telephone diaphragm have only been made at one point of the surface—usually at the center. In preparing this paper measurements were extended over the entire vibrating surface, by the use of a specially designed and constructed vibration explorer, consisting essentially of a minute triangular mirror, carried on a thin stirrup strip of phosphor-bronze ribbon, and with its point held by spring pressure against the surface of the vibrating diaphragm at any point to be explored. A beam of light, reflected from the mirror, indicated the amplitude of vibration.

Between the limits explored of 100 and 2000 vibratory cycles per second, acoustically impressed upon telephone-receiver diaphragms, only the fundamental mode of motion was observed. Contour lines of amplitude were found to be approximately concentric circles, except in the case of receivers with bipolar electromagnetic excitation, in which two maxima were observed, one nearly over each pole. Curves of amplitude along a radius of the diaphragm were presented and analyzed. With acoustic excitation and good flat clamping around the edge, these curves corresponded satisfactorily with those deduced from Rayleigh's Bessel-function formulas for the free undamped vibration of such plates.

The authors suggested means, based on the velocity-circle diagram, for comparing the acoustic intensities of organ pipes of different pitches. In some small thin-glass diaphragms three modes of vibratory motion were observed in the range of acoustic impressed frequency up to 1700 cycles per second. The authors acknowledged their indebtedness to the American Telephone & Telegraph Company for affording the means of executing the work, and also to Dr. George A. Campbell.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Alternator Diagram.—ANDRÉ BLONDEL.—A French Academy paper describing a method of plotting the diagram of an alternator with the primary winding distributed uniformly along the air-gap. The author finally shows how this method may even be made use of in cases in which the winding does not cover the whole periphery. —*L'Industrie Elec.*, May 10, 1915.

Tests of Alternators.—M. LAPINÉ.—An article illustrated by diagrams on a simple method of testing an alternator under normal running conditions without using a motor of the same rating or a self-inductor of the same apparent power, with notes on additional efficiency and regulation tests.—*L'Industrie Elec.*, May 10, 1915.

Lamps and Lighting

The Melting Point of Tungsten.—IRVING LANGMUIR. —Observations on evacuated and on gas-filled tungsten lamps indicate that the intrinsic brilliancy of solid tungsten, at a temperature just below the melting point, is about 7200 international candles per square centimeter, which corresponds to a temperature of 3540 deg. K. for the melting point. Two other methods for determining the melting point by means of a Holborn-Kurlbaum pyrometer were also employed. In the first the black-body temperature of tungsten filaments heated to their melting point is determined, while the emissivity is measured by observations on helically wound filaments. In the second method an alternating-current arc is passed between two tungsten electrodes placed close together in an atmosphere of nitrogen, and the current is increased until the surfaces of both electrodes are molten. By measuring the intrinsic brilliancy of the molten surface, as well as that of the image of one electrode reflected in the other, the black-body temperature and the reflectivity can be simultaneously measured on the same surface. The first of these methods gave for solid tungsten an emissivity of 0.46 and an average melting point of 3532 deg. K. The second method gave the emissivity of molten tungsten as 0.425 and the melting point as 3566 deg. K.—*Physical Review*, August, 1915.

Visibility of Radiation in the Red End of the Visible Spectrum.—EDWARD P. HYDE AND W. E. FORSYTHE.— The determination of the sensibility of the eye to radiation in different regions of the visible spectrum has long been a matter of interest to photometrists. Owing to the difficulty of obtaining sufficient illumination near the ends of the visible spectrum where the sensibility of the eye is small, the various published data are confined to the more luminous regions of the spectrum. Nutting, who has carried his measurements further into the red than has any other observer, gives values of the visibility out to 0.7μ, but in the last-named region the observed values are given only to one significant figure. In connection with a problem in optical pyrometry undertaken in the Nela Research Laboratory it was important to know the visibility of radiation with a reasonable degree of accuracy in the red end of the spectrum. An attempt to determine the sensibility of the eye in this region of the spectrum by the method outlined below proved successful. The method employed involved the use of a modified form of the Holborn-Kurlbaum optical pyrometer. The essential advantage of the method over those employed in previous investigations consists in the availability of higher intensities of retinal illumination. The apparatus used is shown in Fig. 1. The spectrum of a broad vertical carbon filament *A* is formed by means of a Hilger constant deviation spectrometer in the focal plane of the telescope object-glass, in which plane is placed the horizontal filament of a second lamp *F*. A lens *H* projects an image of this filament and of the background spectrum on a narrow vertical slit *I* in the focus of the eyepiece *K*. By rotating the drumhead of the spectrometer any spectral region may thus be brought into the field of view and compared in intensity with the pyrometer filament operated at a constant current. Rotating sectored disks placed between the carbon filament *A* and the colimator slit *C* of the spectrometer and quite close to the latter served to reduce the apparent brightness in the more luminous regions of the spectrum, the final settings being made by turning the drumhead of the spectrometer. Knowing the energy curve of the lamp *A* and making the necessary corrections for the dispersion of the prism, the slit-widths, the selective absorption of the prism and lenses, and the scattered light, visibility data were obtained for nine observers. It is pointed out that these data refer to a very small size of field and to an intensity of illumination of the retina well beyond that at which complications are encountered owing to the Purkinje phenomenon. The results obtained by the nine observers as compared with previous determinations are shown in the table.—Presented at Washington meeting *American Physical Society.*

VISIBILITY DATA IN THE RED END OF THE SPECTRUM

Wave-Lengths	Mean Visibility of Nine Subjects	Mean Values Given by Nutting	Mean Values Given by Ives	König's Values
0.620	252.0	227.0	221	189
0.630	164.0	164.0	156	143
0.640	100.0	100.0	100	100
0.650	58.0	62.0	59	61
0.660	30.0	34.0	39*	33
0.670	15.7	18.6	25*	15
0.680	7.6	8.0	15*	....
0.690	3.8	4.7	....	....
0.700	1.87	1.3	....	....
0.710	0.91	....	....	....
0.720	0.45	....	....	....
0.730	0.22	....	....	....
0.740	0.111	....	....	....
0.750	0.056	....	....	....
0.760	0.029	....	....	....
0.770	0.014	....	....	....

*Extrapolated values.

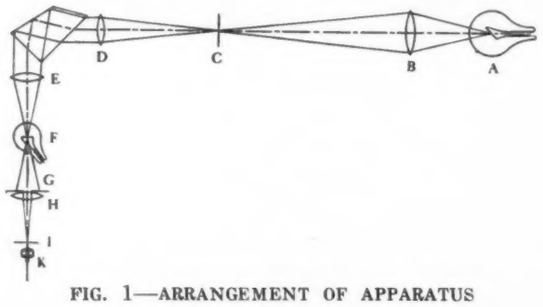


FIG. 1—ARRANGEMENT OF APPARATUS

Generation, Transmission and Distribution

Hoisting in Mines.—G. B. ROSENBLATT.—An illustrated article giving some features of the electric equipment for the Granite Mountain shaft of the Northern Butte Mining Company in Montana. The electrical equipment on the hoist is designed to handle 7 tons of ore per trip. The ordinary operating rope speed is 2700 ft. per minute. The hoist itself has cylindrical drums

12 ft. in diameter, and the rope to be used is 1⅝-in. plow-steel cable. To drive this hoist with an electric motor and still not draw excessive peaks of power from the electric power line, the Ilgner system was decided upon. In this system a direct-current motor is used on the hoist and supplied with power from a direct-current generator, forming part of a motor-generator set. The motor of this motor-generator set is supplied with power from the electric supply line. Mounted on the shaft of the motor-generator set is a flywheel the duty of which it is to equalize the amount of power drawn by the alternating-current motor from the power line. The installation was made with special consideration to "safety first."—*Journal Ass'n Eng'ing Societies*, May, 1915.

Installations, Systems and Appliances

Battery Reserve in an Alternating-Current System.—In 1896 a power plant was installed in the city of Versailles to supply direct current at 560 volts for the railways, and single-phase current at 2300 volts and sixty cycles for lighting and general power purposes. In 1910 the transmission system of the Sud-Lumière company reached the city, and it was decided to buy all necessary energy from this corporation in form of three-phase current at 5500 volts and twenty-five cycles. For this purpose five converting sets were installed consisting of two groups of transformers and synchronous generators to feed the traction system and three

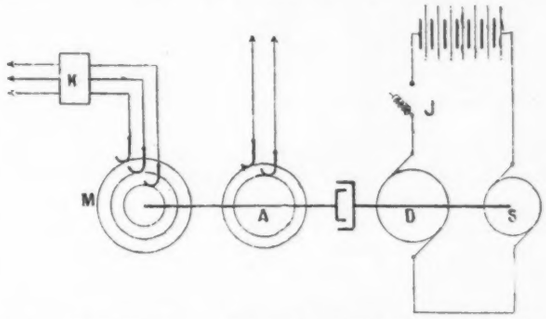


FIG. 2—CONNECTIONS OF MOTOR-GENERATOR AND BOOSTER

groups of 300-kw. synchronous motor-generators to supply the single-phase current for lighting and power. To insure certainty and continuity of supply it was decided to use a battery, the principle of the scheme being indicated in Fig. 2. *M* is the synchronous three-phase motor and *A* is the single-phase generator of a motor-generator set, and directly coupled to this set is a set made up of a 300-kw. direct-current dynamo *D* and booster *S*, these two machines being mounted on the same shaft. The two machines are arranged with windings in series and are connected to the terminals of a storage battery. In normal operation the dynamo *D* and the booster *S* operate exactly in opposition to the battery and no work is done. If, however, the synchronous motor *M* should stop for some reason, the dynamo *D* becomes at once a motor and the booster *S* furnishes automatically the electromotive force required to compensate for the voltage drop of the battery and the drop in the speed of the motor caused by the load. When the motor *M* stops, the booster *S* has to maintain the normal speed of the set, the voltage of the booster being added to that of the battery. On the other hand, at those times in which the battery is charged, *S* adds its electromotive force to that of the dynamo *D*, which then operates as a generator. Hence the potential difference at the terminals of the booster is added in one case to and subtracted in the other case from the voltage of the battery. In order to facilitate the necessary reversal of the electromotive force, the booster is provided with a differential excitation. As shown in Fig. 3, the two exciting windings of the booster are connected in the two halves of a three-wire network in connection with a "potentiometric rheostat," the details of which are more closely shown in Fig. 4. This arrangement permits the adjustment of the electromotive force of the booster to any value whatsoever in a perfectly continuous manner without interruption or reversal of

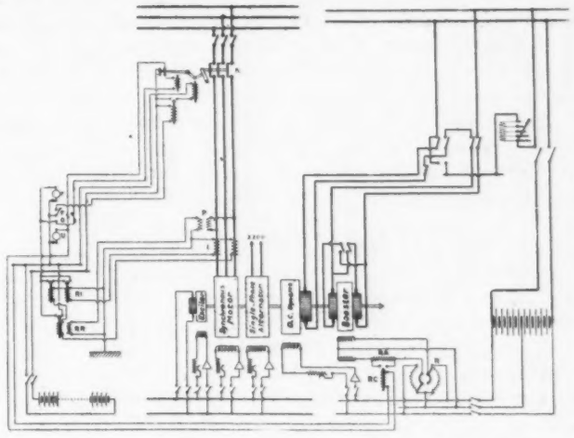


FIG. 3—GENERAL SCHEME OF INSTALLATION

the exciting current. The booster is provided with two commutators, which are in parallel under most conditions but which may be connected in series during the operation of charging the battery. In Fig. 3 *I* is a current transformer, *P* a potential transformer, *J* the switch for the dynamo-booster set, *K* an automatic circuit-breaker, *R* the double potentiometric rheostat, *RA* an additional resistance, and *RC*, *RI* and *RR* relays. Under normal operation when the battery is neither charged nor discharged the differential excitation of the booster is so adjusted that the potential difference at the terminals is zero. At the instant in which the automatic circuit-breaker *K* of the synchronous motor operates the additional resistance *RA* inserted in one of the

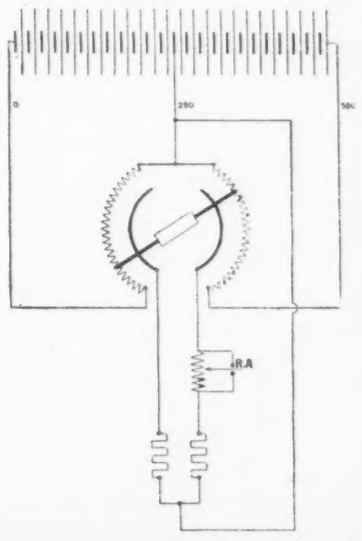


FIG. 4—CIRCUITS OF POTENTIOMETRIC RHEOSTAT

two exciting windings of the booster is automatically short-circuited by a relay, and in this way the equilibrium in the differential excitation of the booster is disturbed so that the booster gives the required voltage. It is interesting to note that a single resistance properly chosen is sufficient to maintain in all cases the normal speed within 3 per cent in such a way that when the

high-tension three-phase system is in order again the synchronous motor can again be connected to the network. The resistances *RA* of the three groups are so dimensioned that the load divides itself equally between the groups.—*La Revue Elec.*, March 19 (published June 11), 1915.

Electrophysics and Magnetism

Laws of Induction.—DAVID ROBERTSON.—With reference to the extended discussion on this subject started by a recent paper of Blondel, the author says he has found it best to standardize two forms of the induction law for use in different cases as follows: Local form—When a body cuts across a magnetic field, an electromotive force is induced in it proportional to the rate of cutting flux and in the way of a current opposing the relative motion; total form—When the flux through a circuit is changing, an electromotive force is induced in it proportional to the rate of change and in the way of a current opposing the change. Neither form is restricted to conductors; they apply also to insulators, in which the induced electromotive forces produce dielectric strain, causing sufficient dielectric electromotive force to balance that induced. The first form is the more convenient when dealing with the electromotive forces in parts of a circuit, such as individual armature bars, homopolar inductors, etc. (in fact, most, but not all, cases of motion electromotive force), while the second is better when considering the total electromotive force in a coil or closed circuit, such as in a transformer or induction coil (inductance electromotive forces and a few cases of motion electromotive forces).—London *Electrician*, July 2, 1915.

Electronic Theory.—A mathematical paper by G. H. Livens on the number of electrons concerned in metallic conduction and another highly theoretical paper on the fundamental differential equation of the electron theory of metallic conduction.—*Phil. Mag.*, July, 1915.

Units, Measurements and Instruments

Ionization Potential of the Roentgen-Ray Tube.—E. C. DREW.—A brief abstract of an American Physical Society paper. In many recent publications the statement is made that the ionization potential of an X-ray tube is very much greater than the running potential, or, in other words, that it takes a much higher voltage to break down the resistance of the tube than it does to maintain the flow of current, once the current is started. An experimental investigation of the point has been made by the author with several standard-type tubes. The current through the tube and the fall of potential across the tube are recorded by a loop oscillograph. The measurement of potential by an indirect method eliminates the objection to a direct one, viz., the same current through the loop as through the tube. Each loop system is calibrated to read drop or current as required, and the instantaneous values of the wave form are scaled off. From the values thus obtained plots are made which indicate that the ionizing potential is not of the same order generally supposed. The law of current in the tube is not that of Ohm. The energy of ionization and the percentage that this bears to the total energy supplied is not the same in different types of tubes.—*Phys. Review*, July, 1915.

Telegraphy, Telephony and Signals

Layout of Telephone Exchange.—THOMAS PEARSON.—A paper on fundamental principles involved in the layout of a telephone exchange and system. The author discusses how to locate the telephone center, the economic dividing line between telephone centers, and the problem of town planning and its effect on economic layouts. The paper is illustrated by numerous diagrams.—*Trans. South African Inst. Elec. Engrs.*, May, 1915.

Book Reviews

CALCUL DES LIGNES AÉRIENNES À POINT DE VUE MÉCANIQUE PAR DES ABAQUES. By André Blondel. Paris, France: La Lumière Electrique. 64 pages, 33 illus. Price, 5 francs.

A reprint of an excellent and very interesting article by M. Blondel on the computation of aerial spans for transmission-line conductors by means of charts and diagrams. The author produced a set of charts for this work as early as 1902, and new sets in 1910, 1912 and 1913. The particular advantages of the different sets are pointed out. There can be no doubt that once the theory of the suspension of uniform conductors has been comprehended by the engineering student the graphical chart has a great advantage over tables for the work of the engineer. As in so many other lines of electrical engineering, Blondel has been a pioneer in the production of these graphs. The pamphlet will recommend itself to all transmission-line engineering students and to many students of applied mathematics.

PURCHASING. By C. S. Rindsfoos, C.E. New York: McGraw-Hill Book Company, Inc. 166 pages. Price, $2.

The author has incorporated in a very few pages an excellent realization of the enormous problems involved in the art of purchasing, whether on a small scale or a large, whether for a private or a public undertaking. By eliminating technical language as far as possible he has rendered the book exceedingly readable. In turn the following problems are taken up, each constituting a chapter: How to obtain the right article; how to obtain the lowest price; how to obtain prompt delivery; making the purchase conform to fixed policy; how to obtain favorable terms; personal characteristics and qualifications; strategy; some of the legal aspects of purchasing; department organization and forms. Under the chapter of departmental organization is incorporated almost the entire report of the proposed system for the centralized purchase and storage of supplies for the city of New York. The book will appeal strongly to executives in charge of the purchasing side of their respective organizations.

THEORIE DER ELEKTRIZITÄT. By Dr. M. Abraham. Leipzig, Germany: B. G. Teubner. 402 pages, 11 illus. Price, 11 marks.

This is the third edition of the second volume of Doctor Abraham's theory of electricity and is concerned with the electromagnetic theory of radiation. It discusses the most recent applications of Maxwell's theory of the ether to the mechanics of electrons and to their radiation. The book is divided into two sections, dealing respectively with the field and motion of single electrons and with the electromagnetic properties of ponderable bodies. The seven chapters of the book relate to the following subjects: Physical and mathematical bases of electron theory; radiation from a moving-point charge; mechanics of electrons; stationary bodies; moving bodies; mechanics of radiation pressure, and theory of relativity. The theory of relativity, which is the final subject of discussion, is very ably treated. It is shown that this Einstein theory of interconnected space and time depends upon the postulate that the velocity of light is invariable in fixed space. On the other hand, the alternative theory that matter is distorted by motion through space again depends on certain postulates, whereby the conclusion is derived that a spherical world in motion becomes converted into a Heaviside ellipsoid. The book will be of interest to advanced students of electromagnetic theory.

POWER AND OPERATING SECTION

PUMPING AND LOADING SAND

Equipment Used for This Purpose and Expense of Operating by Steam and Motor Drives

BY A. E. SMITH*

About 1 mile north of Little Rock, Ark., on the Arkansas River, is a partially submerged sandbar which during low water has been used by building contractors as a source of supply for sand for building purposes. The method formerly used for handling the material was rather crude, a steamboat and barge outfit being used for pumping and conveying the sand. The steam equipment on the boat furnished the power to pump a mixture of sand and water into the barge. In this method of handling the sand there was considerable loss due to the fact that there were five distinct operations between the starting point and the final delivery to the wagons.

FIG. 1—BARGE USED WITH MOTOR-DRIVEN SAND PUMP

The electrically operated pumping outfit that is now being used consists of a 100-hp., 2300-volt motor, directly connected to a 10-in. Morris sand pump installed on a small barge situated close to the sandbar and about 100 ft. from the bank of the river. From the barge a pipe line extends to a hopper on the bank, where the water in the mixture pumped drains off, leaving the sand. A screen is used to prevent large stones and gravel from mixing with the sand. Through openings in the bottom of the hopper the sand runs into specially constructed cars holding 5 yd. each. These cars are operated on an inclined railroad. At the top of the incline a 50-hp. motor geared direct to a hoisting machine is installed which hauls the loaded cars to a point directly over the railroad track, where an automatic arrangement dumps the sand into railway cars.

TABLE I—COST OF HANDLING SAND BY STEAM MACHINERY

Year and Month		Yards Output	Cost of Coal	Total Repairs, Labor, Coal, Etc.
1911	October	8,530.95	$300.91	$1,502.40
	November	7,269.35	.....	1,025.66
	December	7,300.00	282.24	965.99
1912	January	5,991.17	346.14	928.00
	February	7,966.15	331.71	958.58
	March	8,243.58	474.09	1,164.09
	April	7,836.70	156.31	676.31
	May	8,064.66	394.08	994.08
	June	8,598.43	181.80	1,061.43
	July	9,211.76	481.63	795.25
	August	8,999.81	298.82	1,015.92
	September	6,760.03	276.48	888.85
Total		94,772.60	$3,524.21	$11,976.56

Average cost per yard of sand pumped, 12.5 cents.

TABLE II—COST OF HANDLING SAND BY MOTOR DRIVE

Year and Month		Yards Output	Kw.-hr.	Bill for Motor Service	Repairs, Etc.	Total
1914	June	5,478.79	7,190	$199.75	$563.07	$762.82
	July	6,495.28	2,220	75.00	687.82	762.82
	August	6,417.21	6,260	156.50	606.33	762.83
	September	5,286.16	5,440	136.00	305.36	441.36
	October	5,105.39	3,130	78.25	819.16	897.41
	November	5,270.85	4,120	103.00	478.94	681.94
	December	4,118.01	2,310	75.00	378.36	453.36
1915	January	3,706.53	2,390	75.00	246.47	321.47
	February	3,450.56	1,946	75.00	485.28	560.20
	March	6,225.96	2,815	75.00	588.02	663.02
	April	4,816.11	3,234	75.00	410.57	485.57
	May	5,166.20	1,494	75.00	544.29	619.29
		61,537.05	42,549	$1198.50	$6113.67	$7312.17

Average cost per yard of sand pumped, 11.8 cents.

The motor-driven outfit was installed in the early part of April, 1914, and so far has proved satisfactory. The manager of the plant has furnished the accompanying operating costs and output of the steam-operated apparatus from October, 1911, to September, 1912, inclusive, as well as a statement of operating costs from June, 1914, to May, 1915, inclusive, for the electrical equipment. Some experimenting with the motor-driven outfit has shown that the proper mixture of sand and water pumped has a decided influence on the energy taken by the motor. This is shown by the kilowatt-

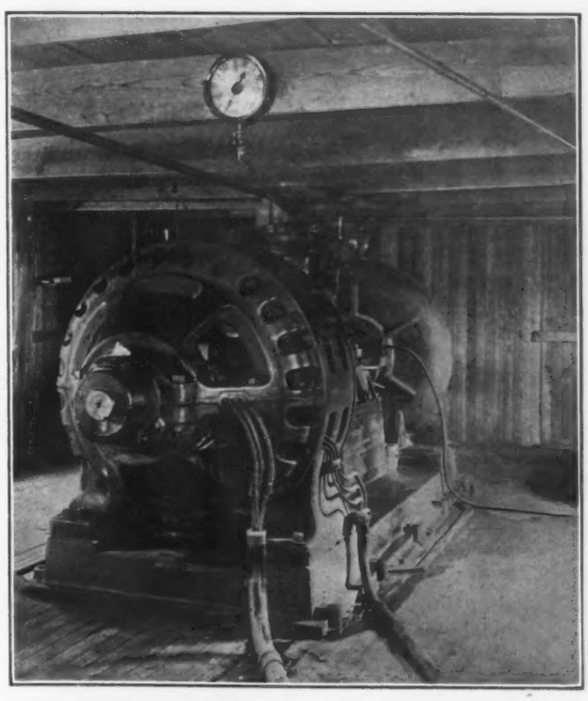


FIG. 2—A 100-HP., 2300-VOLT MOTOR DRIVING SAND PUMP

*Commercial manager Little Rock (Ark.) Railway & Electric Company.

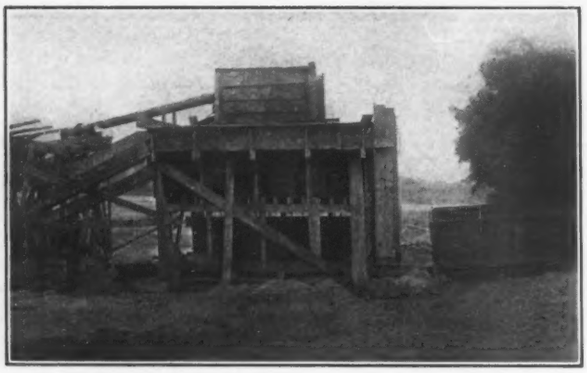


FIG. 3—HOPPER THAT RECEIVES SAND FROM PUMP AND CAR THAT DELIVERS IT TO RAILROAD TRACKS

hours used during the months of June, August, September and November, 1914, as compared with the output and energy required for the other months of 1914 and 1915.

The tabulated data show the cost of pumping the sand with steam-driven machinery and the cost when using motor drive.

How One Operator Controlled an Air-Compressor Motor and Used It to Drive a Direct-Current Generator

BY H. R. SMITH

In the accompanying illustrations arrangements are shown whereby a garage owner secured automatic control of a motor-driven air compressor and at the same time and from the same alternating-current supply was able to use a lathe equipped with a 500-volt direct-current motor. This lathe motor was of variable-speed 2-hp., 500-volt Reliance design, with a speed range of from 500 to 1500 r.p.m., which was required for the lathe work. Since the installation was outside a 500-volt direct-current supply zone, the use of a single-

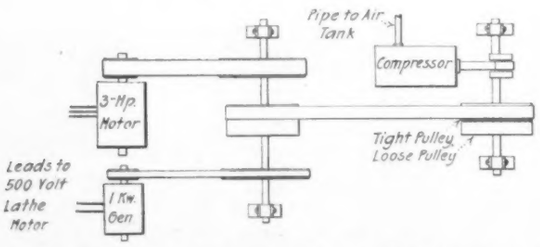


FIG. 1—A SCHEME THAT PERMITS A MOTOR TO DRIVE AN AIR COMPRESSOR AND A GENERATOR

phase, variable-speed motor, calling for an expenditure of $205, would have been necessary. It was decided, therefore, to use a 1-kw., 500-volt direct-current generator belted to the line shaft driven by the air-compressor motor according to the arrangement in Fig. 1.

The method used to obtain automatic control of air pressure and a simple way of cutting out the control when the lathe is used are shown in Fig. 2. The operation is as follows: When the lathe is not in use the snap switch is always open, and whenever the air pressure falls below 120 lb. the regulator diaphragm *a* releases the spring-closing contact *b*, energizing the coils of the solenoid switch and connecting the main leads to motor leads so that the motor starts. When the air pressure reaches 150 lb. the diaphragm *a* opens the contact *b*, which opens the solenoid switch and stops the motor.

When it is desired to operate the lathe, the snap switch (Fig. 2) is closed allowing the solenoid switch to be energized, and thus starting the motor. When air pressure reaches 150 lb. the compressor belt is thrown to its loose pulley, and the motor drives the generator only, furnishing 500 volts direct current through fuses and a switch to the lathe motor.

All of the apparatus shown in Fig. 1 is mounted on a platform consisting of six long-leaf yellow-pine planks, 12 in. by 3 in. by 10 ft. long, supported between angle irons close to the roof. The apparatus shown in Fig. 2 is installed on a wooden service board, 18 in. by 24 in., attached to the wall in easy reach of the operator.

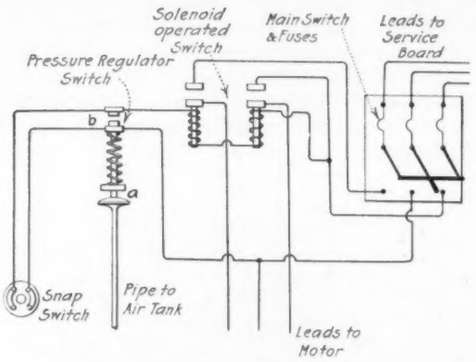


FIG. 2—CIRCUITS FOR THE AUTOMATIC CONTROL OF AIR PRESSURE

The apparatus called for by this installation was as follows:

One Westinghouse, type CCL, two-phase, sixty-cycle, 220-volt, 1740-r.p.m., 3-hp. motor.
One Westinghouse, type SK, 1.5-kw., 500-volt generator.
One Cutler-Hammer pressure regulator.
One Cutler-Hammer solenoid switch.
One main switch, two-phase, 30 amp., and fuses with metal box.
One 500-volt, 30-amp., two-pole switch and fuses with metal box.
75 ft. of 0.5-in. conduit.
200 ft. of No. 14 wire.
One 15-amp. snap switch.

It took a wiring contractor and helper two days to set the motor and switches and do the wiring. All the apparatus was furnished, the wiring installed and the countershafts set at a cost of $190.

Ways to Save Hot Water from Drains and Measure It by Steam Trap

Steam pipes that are not connected to a special drainage system should be drained whenever possible through apparatus which can handle hot water. For example, when heaters in toilet rooms have traps on their outlets intended to let water by and prevent the passage of steam, the branch from the steam line which feeds these heaters should be taken out at the bottom of the steam line at such a point as to drain the line and not require a separate steam trap. The hot water returned to the hot-water heater will contain some heat which would otherwise be lost if the drain discharged into the sewer. In the same way, reciprocating pumps may often be used to drain steam lines, because there is no objection to allowing the water to blow through the pump with the steam so long as it is a continuous operation and the water does not accumulate and come in gulps. In connection with manufacturing steam lines, it is good practice as far as possible to take

branch lines out of the bottom of the steam header or main and let branches out of the top of the header be the exception. In this way the need of a large number of traps on headers and mains can readily be avoided.

In a manufacturing plant where it is desired to measure the condensed steam as a basis of charge for the steam used by different departments such as drying ovens, glue pots, etc., the tiling type of steam traps may be made to serve an additional purpose. Each operation of this trap represents a certain number of pounds of condensate, so that by properly attaching counters to record the operation of the trap a continuous record of steam consumption for the line to which it is connected may be secured.

How Smokeless Combustion Is Secured by the Boston Edison Company

The furnaces at the L Street station of the Edison Electric Illuminating Company of Boston have been remodeled in an effort to bring about smokeless combustion. The furnaces are equipped with side-feed stokers and connected with chimneys sufficiently large for using natural draft. The type of furnace construction is shown in an accompanying illustration. Coal is delivered by belt conveyors to bunkers over the boilers and fed by gravity down chutes to coal magazines extending along both sides of each furnace, as shown in Fig. 1. When the coal reaches the bottom of the magazine or coking plate, air which has been heated in the space over the furnace arch shown in Fig. 2 passes, by means of the ducts cast in the arch plate, through the green fuel. Volatile gases driven off by the heat mix with the heated air and pass along under the heated arch. By this arrangement the temperature of the gases is kept high and the combustion sufficiently complete satisfactorily to prevent smoke issuing from the chimney.

In this type of furnace the coal is pushed off the coking plate into the grate by the stoker boxes, which are made to travel in and out by means of gearing. The coal travels down the grate owing to the motion of grate bars, and at the foot of the grate a rotary clinker crusher forces ashes and clinkers into the ash pit below. The speed of the crusher can be varied for changes in percentage of ash and clinker, and to soften the clinkers and keep the grate cool the stoker engines are allowed to exhaust under the grates. Any unburned coal which may fall through the grate into the sifting pits can be drawn out and fired into the furnace. The ashes are transferred from the ash pit directly into carts and carried away.

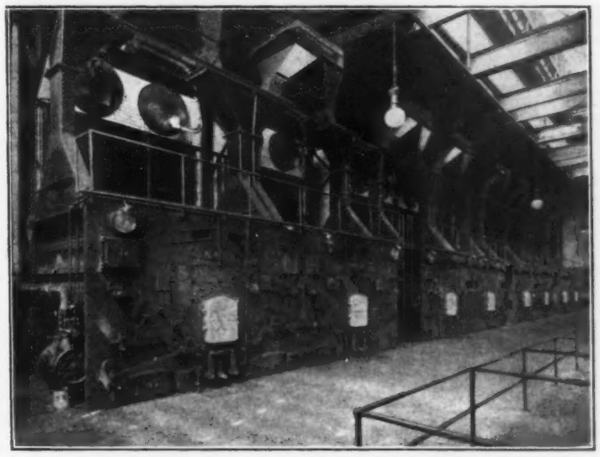


FIG. 1—SIDE-FEED STOKERS AT L STREET STATION OF BOSTON EDISON COMPANY

According to Mr. R. E. Dillon of the Boston Company, the furnaces can be forced to 300 per cent of rating by forcing steam and air under pressure into the ash pit, and with natural draft alone 200 per cent rating can be easily maintained with smokeless combustion.

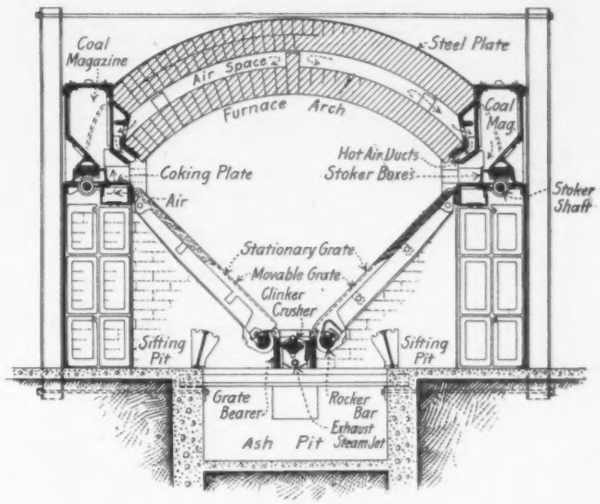


FIG. 2—SECTION THROUGH FURNACE SHOWING PATH OF HEATED AIR SUPPLY

Use of Copper-Clad and Iron Wire on Lines Serving Small Loads

In the sparsely settled districts where electrical energy from the system of the Pacific Power & Light Company is used for irrigation the use of copper-clad wire makes extensions possible because of its being about one-third cheaper than the required size of copper. When the load on any such line becomes large enough to cause an excessive drop in voltage, the copper-clad is substituted for the required size of copper conductor. According to Mr. G. D. Longmuir, local manager of the company at Pasco, Wash., considerable No. 8 iron wire for short tap-offs and branch lines on 6600-volt circuits is also used when the load is light, without serious trouble on account of voltage drop arising.

A No. 8 copper-clad line about 10 miles long operated along the Columbia River from Pasco at 6600 volts and supplying 110 hp. of irrigation motor drives was recently changed to No. 6 copper in order to make possible the securing of a considerable additional load. This line was first installed to serve a 50-hp. motor load. During reconstruction it was essential to keep the line alive to provide continuity of service to irrigation pumps, and to do this the three No. 6 copper conductors in half-mile lengths were strung on the cross-arms in position beneath the insulators to which they were to be attached, the conductors being pulled up to regular line tension and dead-ended on the poles. This process was continued for about 3 miles, and then the line was killed at night to permit of tying in and splicing at the half-mile points. Only three such interruptions were necessary, the lines being killed for eleven, ten and eight-hour periods, while at other times service was given over a period of seventeen days. Two linemen and three groundmen were employed for the reconstruction work.

One Year's Records from a Raw-Water Ice Plant

The accompanying tabulated information and data give the electrical equipment of a Middle West raw-water ice plant and the operating conditions for one year. During the period referred to the output ranged between 85.41 and 40.4 tons a day, while the energy consumed per ton of ice produced varied from 58.31 kw.-hr. to 26.7 kw.-hr. It would naturally be expected that the energy consumed per ton of ice produced would be lowest when the output was greatest. As shown by the data sheet, however, this is not the case, since more refrigeration is needed in the ice-storage room in summer because less ice is stored there then.

TABLE I—RECORD OF OPERATING CONDITIONS AND UNIT ENERGY CONSUMPTION FOR AN ELECTRICALLY DRIVEN RAW-WATER ICE PLANT

Month	Hours and Minutes per Day Operated	AVERAGE											Tons of Ice per Day	Displacement of Compressors per Ton of Ice per Minute (Cu. In.)	Kw.-hr. per Ton of Ice
		Pressure (Lb. per Sq. In.)			Temperature (Deg. Fahr.)										
		Back	Condenser	Air	Brine	City Water	Water on Cond.	Water off Cond.	Water to Cooling Tower	Water Into Cans	Outdoor Max.	Outdoor Min.			
August	23.17	21.08	160.38	3.32	13.22	70.87	73.50	79.80	76.35	56.00	77.80	70.60	85.07	13,253	46.05
September	22.00	20.43	142.80	3.55	13.00	64.70	66.18	67.80	69.20	48.78	69.50	62.18	85.41	13,200	49.28
October	19.23	20.00	150.20	4.16	13.28	57.42	66.80	7.20	70.10	45.50	58.80	52.10	75.87	14,860	51.11
November	18.40	21.70	115.90	4.31	13.77	47.20	54.70	58.20	57.70	48.20	49.20	44.20	54.00	11,766	42.76
December	17.21	21.10	99.20	4.46	14.00	42.40	46.00	49.00	47.80	45.40	39.90	35.60	50.90	11,075	42.59
January	13.37	23.44	91.80	4.37	15.45	35.90	46.03	49.38	46.60	38.80	34 20	30.80	54.69	10,307	24.87
February	12.53	23.10	100.30	4.20	15.50	35.00	52.10	54.30	54.60	38.20	32.40	27.60	55.20	10,212	56.10
March	12.06	24.30	108.30	4.00	16.10	36.30	55.60	58.10	56.30	39.10	46.30	38.60	40.40	13,953	26.70
April	19.24	20.53	103.30	4.01	15.18	40.00	58.75	62.00	52.53	43.16	59.30	49 30	60.00	10,060	35.50
May	22.37	18.50	142.90	3.62	13.78	53.35	68.90	74.38	70.58	52.00	75 72	63 80	83.15	13,559	42.30
June	23.43	21.44	152.00	3.60	15.24	63.46	72.03	76.40	74.40	65.70	76.90	70.40	71.84	13,862	58.31
July	23.35	20.22	165.30	3.47	13.90	68.90	75.60	79.10	77.30	64.23	80.00	73.22	81.90	13,765	58.28

The demand charge for electric service was $2 a month per kilowatt of maximum demand for all energy except that supplied to the blowers. For the latter the demand charge was $3 a month per kilowatt. The maximum demand of each piece of apparatus is given in Table II. In addition to the demand charge, an energy rate of 0.6 cent per kilowatt-hour was charged. The total cost of energy for the year was $9,320.31, and the output of the plant was 22,840.6 tons, showing the cost per ton of ice made to be $0.408. A total of 1,004,044 kw.-hr. was required, making the average cost per kilowatt-hour $9,320.31 ÷ 1,004,044 = $0.0093.

TABLE II—MOTOR-DRIVEN APPARATUS IN A RAW-WATER ICE PLANT

Motor Rating	Machine Driven	Maximum Power Demand, Kw.
200-hp., 500-r.p.m. slip-ring Wagner	14-in. by 30-in. Huetteman & Cramer ammonia compressor with 18-ft., 22,000-lb. flywheel revolving at 63 r.p.m., driven by 30-in. double leather belt	147
Do.	Do.	.....
5-hp., 1140-r.p.m. Wagner	Two 18-in. brine agitators operating at 150 r.p.m.	3
15-hp., 1720-r.p.m. Wagner	Two air blowers operating at 400 r.p.m. to agitate water in cans	8
5-hp. Wagner	Core pump operating at 350 r.p.m.	2
15-hp., 1120-r.p.m. Wagner	Pump circulating water over cooling tower	.....
1-hp. Wagner	Traveling bridge of ice crane carrying three 400-lb. cakes.	
1.5-hp. Wagner	Hoist on ice crane carrying three 400-lb. cakes	1.5
3-hp. Wagner	Pump conveying water from thawing-tank overflow to cooling tower	1.5
3-hp. Wagner	Ice elevator carrying one 400-lb. cake at a time	2

In addition to the equipment given in Table II the following are installed: An 18-ft. by 31-ft. by 5-ft. freezing tank designed to hold 888 400-lb. ice cans which are cooled by 15,788 linear ft. of 1.25-in pipe arranged in twenty-six coils and connected with a vertical accumulator; a 47,100-cu. ft. ice-storage room; washers and coolers for the air used in agitating the water in the cans; thawing tanks for removing the ice from cans; quartz-bed water filters and coagulating tanks; natural-draft cooling tower, and the equipment for condensing the ammonia.

Chain Data for Motor Drives

In a New York paint factory the problem of securing a suitable grouping of motors, driving shafts and machines was solved by the use of chains. The basis for the selection of chains over belts was the demand of certain machine operations for constant speed. In the grinding department the company had experienced serious variations due to slipping of belts, a feature that has been eliminated by installing chains. The short centers of 28 in. made possible a convenient arrangement of machines and driving shafts, the chains and motors being mounted on the floor.

DATA FOR MOTOR TO LINE SHAFT AND LINE SHAFT TO PAINT-GRINDER CHAIN DRIVES

	Motor to Line Shaft Chain Gears		Line Shaft to Grinder Chain Gears	
	Motor Sprockets	Line Shaft Sprockets	Line Shaft Sprockets	Grinder Sprockets
Speed in r.p.m.	1200	300	300	150
Pitch	0.75 in.	0.75 in.	0.75 in.	0.75 in.
Diameter	5.02 in.	20 in.	5.02 in.	10.0 in.
Number teeth	21	83	21	41
	Motor to Line-Shaft Chains		Line Shaft to Grinder Chains	
Width	3 in.		1 in. to 3 in.	
Speed	1570 ft. per min.		390 ft. per min.	
Hp transmitted	15		Varies	
Distance between centers	28 in.		28 in.	
Make	Morse		Morse	

Number of motors	8
Number of motors per line shaft	1
Horsepower of each motor	15
Number of grinders per line shaft	14

COMMERCIAL SECTION

The Problems of Slow-Moving Stock

How the Big Electric Shops Protect Themselves Against "Dead Stock" and Its Accompanying Losses

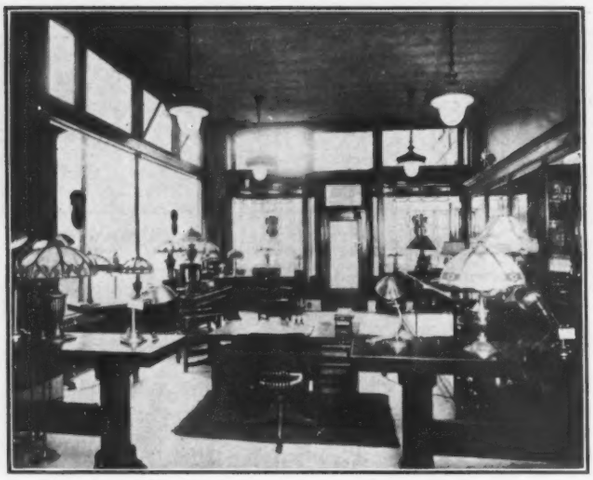
THE business of running an electric store is so young in many cities that in certain important respects experience is necessarily very limited. There is no inborn instinct that makes a merchant of a man when he is called from other duties to assume direction of a shop that sells household electrical appliances. When he steps from active contracting or from some central-station work and undertakes to be a storekeeper he sets himself in competition with the department store, and there are certain things he has to learn. One of the problems that beset him is the management of stock. How do the biggest, most successful and most experienced electric shops take care of this important factor in the work?

Mr. W. G. Stetson, superintendent of the appliance department of the Edison Electric Illuminating Company of Boston, says:

"We do not have very much trouble with dead stock in our fifteen stores at the present time, because of the system which we employ. I first decide that I want to carry an article in stock or to put it into 'the line,' as they say in the trade, and I then make out what is known as a 'standard authorization,' which furnishes a maximum and a minimum on the estimated basis. This maximum-and-minimum authorization establishes the quantity of each article that shall be purchased for stock and the number which shall be sold from stock before a re-order shall be given. This maximum and minimum is revised at the end of every month or two when we actually ascertain how the sales of the particular article are running.

"Every few months I get from the supply department a statement of the inactive stock. This is a statement of what stock has not been selling for the previous six

SHOWCASES ARE USED EXTENSIVELY IN THE ST. LOUIS ELECTRIC SHOP TO PREVENT DEPRECIATION



ANOTHER VIEW IN THE ST. LOUIS ELECTRIC SHOP, SHOWING MORE DISPLAYS PROTECTED BY PLATE GLASS

ONE OF THE FIXTURE-DISPLAY ROOMS IN THE NEW HATFIELD ELECTRIC STORE IN INDIANAPOLIS

months, which periods as you will understand, will overlap, since the reports are made more frequently than semi-annually. If the sales over a considerable period are extremely limited, it is then only necessary to cancel the authorization, which cuts out further orders of the article, and the remaining stock is disposed of at a reduced price, if necessary. Ordinarily, however, a little push put behind the sales of that particular article will be sufficient to clean out the remaining stock, which because of our standard system is apt to be very small."

A Special Employees' Clearing Sale

But in spite of all a man can do—with all vigilance and the best of system—there will be some stock that will drag and will finally have to be disposed of, as Mr. Stetson suggests, by reducing the price or by "baiting" it in some effective manner. They have a way of doing it in the Commonwealth Edison Company's electric shop in Chicago which Mr. George B. Johnson, manager of the electric shop, described as follows:

"We dispose of our slow-moving stock in three ways: First, by being extremely careful in purchasing goods, holding the head sales clerk responsible for disposing of goods within thirty to sixty days from their receipt; second, in always having on sale at special reduced prices certain articles which have not been moving, and, third, in disposing of our left-overs from Christmas to employees of the Commonwealth Edison Company by means of a special employees' clearing sale, held in a location not accessible to the public. This finds a ready and an entirely profitable market for many appliances that would otherwise lie unproductive on the shelves.

"The matter of slow-moving stock," added Mr. Johnson, "is of extreme importance, not only to central-station salesrooms but also to all retail establishments. We watch our stock very closely and keep continually pushing toward the front any articles which seem to stick. I have found good results by placing a 'premium' on the slow-moving articles, so that employees can make a little extra money by working for the sale of certain backward appliances. For instance, in the case of a forty-dollar electric lamp which has been in stock too long, I would allow a special premium of, say, $1 to the employee who succeeds in selling it."

Employees' Auction Sale

In Philadelphia also the company tries to give the employees the fullest opportunity to benefit by such enforced bargains. Mr. Joseph D. Israel, district manager of the Philadelphia Electric Company, takes all shop-worn articles which, while mechanically and electrically perfect, it is impossible or too expensive to refinish, and offers them at auction to company employees, and thus realizes in most cases a sum very near their cost.

"We have held two or three of these auction sales," he said, "during the past winter in connection with some of the section meetings, and have found that this not only stimulates the interest of the employees in attending the section meetings but also interests them in using appliances in their own homes, thus adding to their enthusiasm in pushing appliance sales for the company.

"This dead-stock problem," Mr. Israel went on, "is a point that has received considerable study in our electric shop, and we have succeeded in very materially reducing the amount of unsalable material. The greater proportion of such stock seems to consist of irons which have been sent out on trial and, proving unsatisfactory on account of weight or style, have been returned. The irons themselves are usually in perfect condition, with the exception of the finish, and we find that by sending the irons to an electroplating house we can have them put in the same condition as when received from the factory and sell them as new."

The question of whether backward stock is really "dead" or "merely sleeping" is naturally an important one. Mr. E. R. Davenport, sales manager of the Narragansett Electric Lighting Company in Providence, R. I., advocates making a very strenuous effort to push an article that fails to sell satisfactorily before a bit of profit is cut from the price.

Forcing the Slow Device

"When we find any article in our electric shop that does not seem to move," he said, "we make a special effort to force it, featuring it in window displays and in newspaper advertising, and sometimes, if necessary, we hold a special sale of the device for a limited time. We try to see that our stockroom contains no dead stock at any time, and the stock-keeper in our store is instructed to go over his stock periodically and see that all goods are in perfectly salable condition and to report anything which does not seem to be moving. These instructions are also given to the head salesman in the store, so that one checks up the other.

"In addition to this, we make periodical inspections of all goods in the store and see to it that nothing gets packed away which should be on display and sold. We are seriously considering now the proposition of offering on easy payments everything on sale in the electric shop priced from $3 up. This method, we believe, will do a great deal toward increasing our sales."

The Fundamental Causes

It is essentially a merchandising problem, a problem that engages the attention of every man who operates a retail business house, and it is difficult or simple to him just as he is skilled and thoughtful in the work. "In this day the question of dead appliance stock is, in my opinion, not of very considerable importance," said Mr. C. E. Michel, the manager of the appliance department of the Union Electric Light & Power Company of St. Louis, "for the reason that if even a reasonable amount of ordinary mercantile skill is displayed in the purchase and merchandising of electric appliances, such a stock will be practically non-existent. Where such a problem does exist," he continued, "it is usually traceable to one of two causes—first, ill-advised purchases from the standpoint of either quantity or quality; second, depreciation of sample and display goods. The first of these causes usually arises from one of two conditions, the purchase in large quantities by a purchasing agent in some distant town of appliances for resale, or the local buyer's lack of information, judgment or system.

Long-Distance Buying Difficult

"Take the first of these conditions," Mr. Michel continued. "Certainly it is a hard task for a purchasing agent in some central office to buy appliances in quantities, distribute the articles among several towns and cities for resale, and not load up somebody with goods that will not move. The electric-appliance business has not as yet reached a point of standardization that will permit of this method unless there exists close co-operation between the purchasing agent and some well-informed person in each of the distributing stations so served. The customers in different localities have been educated along different lines, and it simply means increasing the impediments to the general introduction of electric appliances if an attempt be made to sell them one style of article when they desire another. I have one striking example of this in mind.

"There are two comparatively large cities lying in close proximity. In one the demand is for electric irons with attached stands; in the other the call for such an iron is negligible. In the latter city an attempt was made, through the medium of a special sale at very sharp reduction in price, to introduce the iron with the stand attached. This failed, and the sale succeeded only when the style of iron offered was changed to conform with what the public was accustomed to. This condition is typical of the business as a whole. The second condition—depreciation—is really unpardonable. The appliance business is essentially a mercantile proposition, and the man responsible for its success or failure in any locality should certainly be possessed of the attributes of a merchant in a degree proportionate to his field. If he is, he can be relied upon not to fill up his shelves with a lot of unsalable apparatus.

The Danger of Depreciation

"Depreciation exists wherever a showroom is maintained. It can, however, be minimized by following a few simple and self-evident precautions. Display articles to be effective must be kept bright and new, and they cannot be so kept if they are displayed on open tables, as is the case in most localities. Impurities in the atmosphere quickly tarnish the highly polished surface. Experience teaches that well-made display cases check this depreciation to a marked extent, but articles kept in these cases should be carefully gone over and wiped with a soft dry cloth once each week. Then, when a sale is made, the display article is the one that should be delivered to the customer after having been properly packed in an original box, and a new article should take its place in the showcase. In spite of all precautions, certain slow-moving articles will become tarnished or damaged, and while such stock is usually small, unless it be carefully watched it will accumulate. To prevent this we maintain a bargain table in the St. Louis electric shop as a regular feature of our sales policy, and

MAIN SHOWROOM OF THE NEW HATFIELD ELECTRIC STORE AT INDIANAPOLIS DECKED FOR ITS OPENING DAY. NOTE THE USE OF SHOWCASES AND DISPLAY TABLES

on this table place such articles as have from one cause or another got in such shape that they cannot be sold as new. In order that the bargain table may fulfill its function, however, these articles must be priced with due regard to condition and demand. It will be found also that while a slight reduction from the selling price will move certain articles, others will have to be priced below actual cost in order to get them off the shelves. An effective bargain table requires careful watching and a constant change of articles offered. This, of course, is self-evident.

"In the case of articles of comparatively high cost or those that are ready sellers and on which the finish has been impaired, it frequently pays to have them refinished. When this is properly done, the article can be placed in regular stock. The most practicable way of handling this is to arrange with some local concern to take care of this work, and when this is done the cost is small.

The Protective Policy Best

"In general, our policy is to hold but few special sales each year, for the reason that frequent special sales tend to disorganize regular business, and if persisted in work a hardship on those stores depending for their profit on appliances sold to help pay the expense of their establishment. We believe it fundamentally true that many stores distributing electric appliances at regular prices will put out more goods than one central-station appliance department selling at cut prices. It is quite true," said Mr. Michel in conclusion, "that a central station is interested more in the kilowatt-hour consumption of appliances sold than in the financial profits of the appliance department, but this is no good reason why such a department should be stampeded in its buying and selling policy to a point where, when a strict accounting is had at the end of the year, its loss in operating costs over revenue plus depreciation on stock practically wipes out the net revenue accruing from the use of appliances sold."

In short, the operating of an electric shop is essentially a merchant's problem, and no manager can do better than to study the other merchants' methods in the handling of his stock. It is not a new problem to other retail men, and through the years they have evolved many methods of protection. The electric shop manager must take advantage of it and apply their ways to his new kind of merchandising.

An Elaborate Temporary Wiring Installation

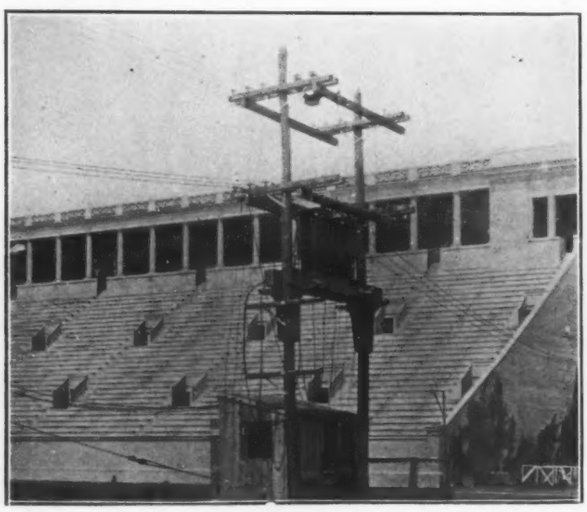
Provisions for Electric Illumination of the Outdoor Performance of "Siegfried" Given in the Harvard Stadium at Cambridge, Mass.

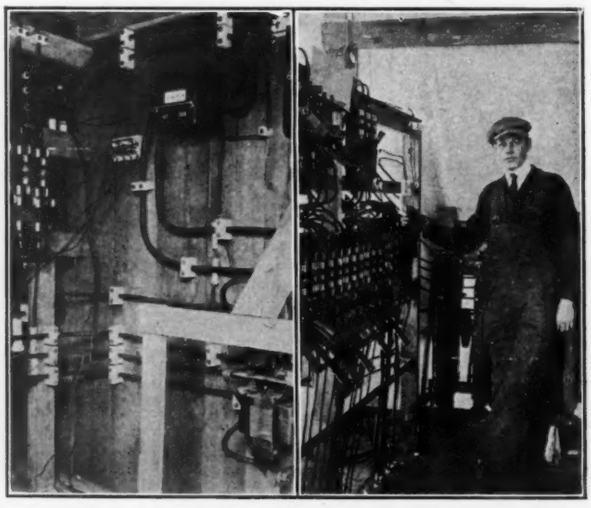
THIRTY thousand people witnessed the recent performance of Wagner's opera "Siegfried" at the Harvard Stadium, Cambridge, Mass., and the success of the performance was greatly enhanced by the special electric lighting provided for the occasion. Under ordinary circumstances there is very little permanent wiring on the Stadium grounds, as almost all the events on the premises occur by daylight. To stage the opera, however, a full-fledged temporary theatrical installation was required, and the result was a revelation of the capabilities of the gas-filled lamp for such service.

Energy Supply for Special Installation

As the Stadium is on the Allston side of the Charles River, the electrical supply was taken from the Edison Electric Illuminating Company of Boston, a special overhead circuit being run to the grounds from the Edison 2300-volt duct system at North Harvard and Western Avenues. About 150 ft. north of the temporary stage a transformer tower was erected, with 110/220-volt feeders leading to a 6-ft. by 9-ft. wooden switch house from which the low-voltage mains were carried overhead to the distribution centers in the Stadium. Two 50-kw. transformers were installed about 20 ft. above the ground, with the usual fuses and disconnecting switches.

The secondary leads were connected in parallel and brought into the switch house in a single circuit which branched into two three-wire cable buses within the house, each branch being separately metered and equipped with an independent cut-out. Four 200-amp. circuits were run from the buses to the Stadium structure, a fifth circuit of the same rating leading to the stage. The latter was 100 ft. long and 60 ft. deep and



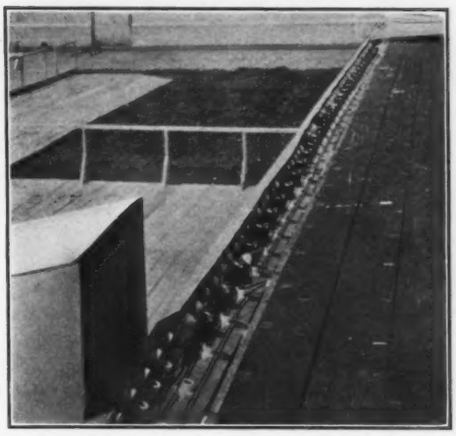


TEMPORARY TRANSFORMER POLE, SWITCH HOUSE, WIRING AND SWITCHBOARD FOR PERFORMANCE OF "SIEGFRIED"

had an 80-ft. proscenium arch, providing ample space for the performance, which was staged by the Metropolitan Opera Company of New York, with the assistance of a group of artists of world-wide renown.

The portion of the Stadium occupied by the public fronted a horseshoe-shaped area about 475 ft. long by 237 ft. wide. On the gridiron section of the grounds and directly in front of the stage and orchestra were built about 552 temporary boxes, and the general illumination of these was provided by hanging six 1000-watt nitrogen-filled lamps about 50 ft. above the seating space, the lamps being hung in three sets of two each by 0.375-in. stranded steel cables spanning the Stadium. With this illumination it was easy to read the libretto, and the general lighting of the seats in the amphitheater permitted newspaper reading at all points. The lamps hung above the box section were provided with opalescent globes.

A total of 27,000 cp. was provided for the general lighting of the Stadium, which included the extensive use of 750-watt bare lamps on temporary wooden brackets along the tiers of seats on the concrete structure forming the amphitheater but did not include eighteen 400-watt and twenty-seven 250-watt lamps used in the general illumination of the grounds. The stairways and colonnade were admirably illuminated by small units of the ordinary tungsten variety, 60-watt and 100-watt lamps being commonly employed. In all about 18 miles of wire was run, mostly on porcelain knobs screwed into wooden brackets or cross-arms which were either fastened to wooden uprights or cleated to the concrete at joints or edges.



FOOTLAMPS ON THE TEMPORARY STAGE

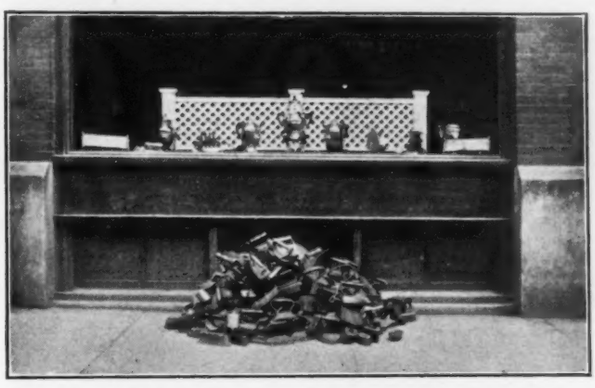
The stage equipment included a temporary frame switchboard carrying fuses and sixteen circuit-control switches, with twelve dimmers, six spotlights rated at about 25 amp. each, and a full installation of red, white and blue foot and border lamps. For the borders 100-watt units were used in the white bulbs and 60-watt units for red and blue lamps. The footlamps were made up of 60-watt white and blue lamps and 50-watt carbon red lamps. Orchestra lamps were fed from a row of outlets provided at the front of and below the footlamps, each orchestra lamp being made up of an inclosed pair of 16-cp. tubular carbon incandescent lamps connected by flexible cord and plug to the stage outlets above mentioned. Two 60-watt lamps on wooden brackets were provided for the stage switchboard operator's service, and the latter was furnished with both electric bell and telephone connections to the transformer station.

The Boston Opera Company furnished spotlights, brackets, strips and scenery, under the direction of Mr. C. J. Sullivan, electrician; the general arrangements were planned by Mr. Frederick G. Gaus, chief electrician Metropolitan Opera House, New York, and the installation was made by Mr. George F. Norris, electrical engineer, Boston, Mass.

Almost a Ton of Evidence

A particularly graphic demonstration of the growing popularity of electric irons in Kokomo, Ind., was recently contrived by Mr. O. M. Booher, new-business manager for the Indiana Railways & Light Company, as shown in the accompanying picture. Electric flatirons to the number of 233 had taken the place of the abandoned sadirons which comprised this pile of junk weighing ¾ ton.

This sidewalk exhibition was an incident of a midsummer flatiron sale in Kokomo, in which a small allowance was offered on every old iron of any kind surrendered to the company. This allowance was applied on the purchase price of an electric iron, and the cash price received for the iron after deducting this allowance was ample to cover all costs. As the old irons were brought in and surrendered they were piled high in the show window, and the growing heap proved most effective in calling attention to the sale.

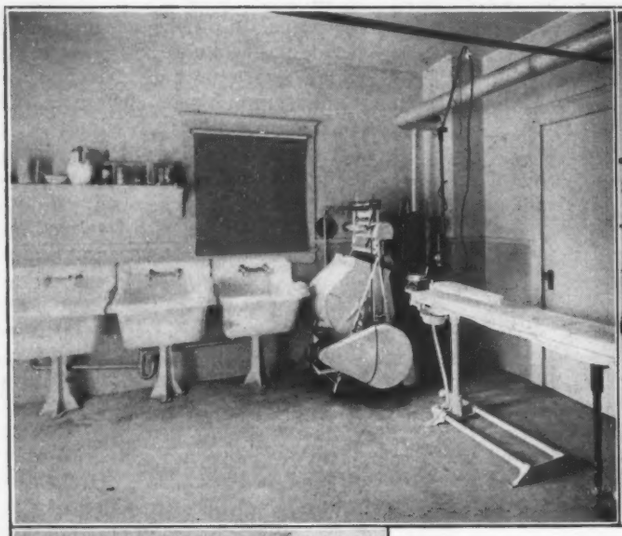


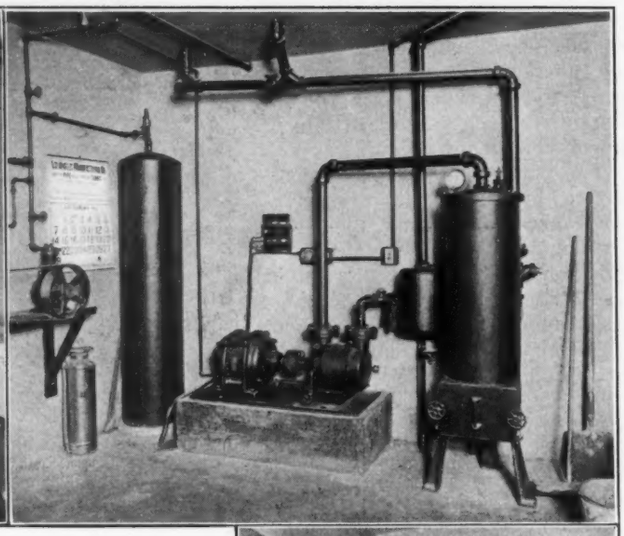
A PILE OF OLD IRONS EXCHANGED FOR NEW

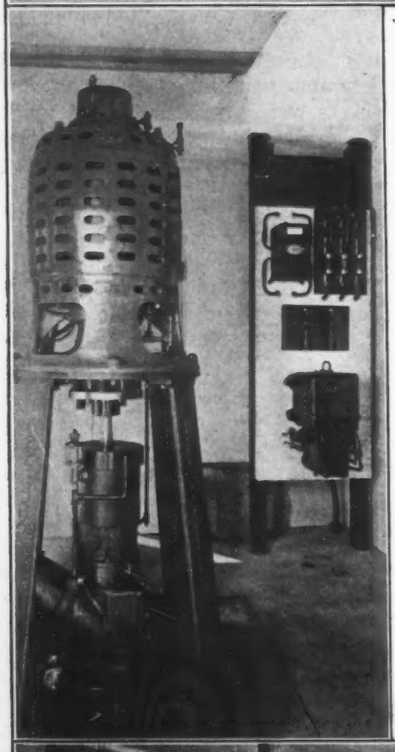
"In addition to the 223 sold on this exchange proposition," writes Mr. Booher, "many irons were sold outright, bringing the total iron sales up to 259 for the month, and the total sales for the year so far to 537. The features of the plan, in addition to that of arousing general interest in other energy-consuming devices, were several. Practically no old electric irons were brought in, which is positive proof that a large percentage of the irons put out went into homes not yet possessing electric irons, or, in other words, homes that had up to that date refused to purchase an iron at the regular price. Also, each exchange closed that particular sale, eliminating the time and effort consumed in following up irons put out on approval."

NEW-BUSINESS GAINS AT KOKOMO, IND.

	June 30, 1914	June 30, 1915	Gain	Gain in Percentage
Number of commercial customers	872	1095	223	25.5
Number of residence customers	2961	3985	1024	34.5
Number of motor customers	188	224	36	19.1
Total number of customers	4021	5304	1283	31.6
Horsepower of motors connected	3054	3268	214	7.0
Number of street lamps	353	414	61	17.2
"White-way" units	90	90	....	....
Iron sales	2097	3030	933	44.5

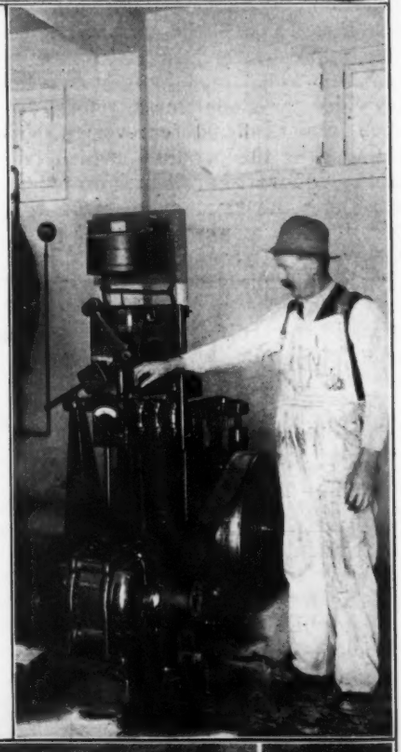


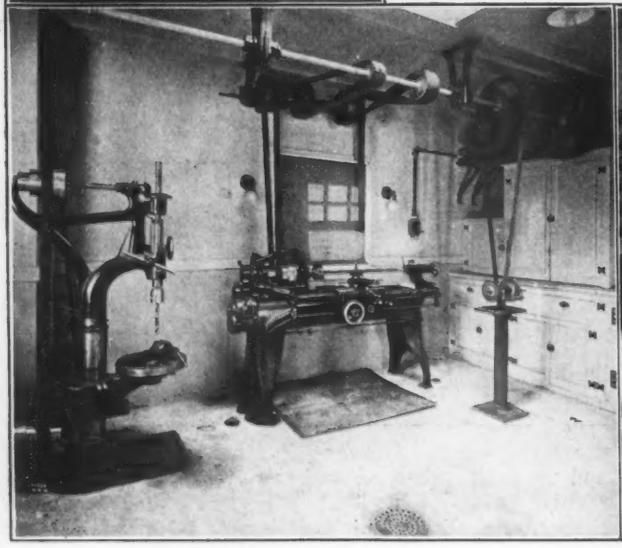


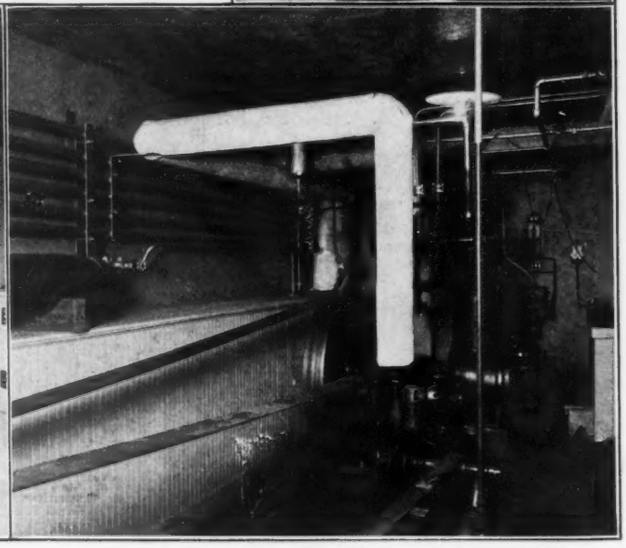


Motor Drive in Many Roles at "Anokia"

At "Anokia," the magnificent ranch home of Mrs. Baldwin on the Santa Anita Ranch, near Los Angeles, Cal., electricity performs every household function, from cooking the dainty dishes which the mistress sets before her guests and cooling the pantries and drinking water to laundering the household linen and vacuum-cleaning the many rooms. Electric pumps deliver the water which makes the great gardens blossom, and an electrified machine shop renders the ranch garage a self-contained economic unit as far as all ordinary repairs are concerned.







Electricity on a Country Estate

The Complete Equipment of the Palatial Ranch Home, "Anokia," of Mrs. Anita Baldwin Near Los Angeles, Cal.

HOUSEHOLD drudgery is done away with, the comforts of the metropolis are brought to the country home, and the artistic beauty of architecture and settings is heightened through the agency of electricity in the recently completed country house, "Anokia," of Mrs. Anita Baldwin near Los Angeles, Cal. The equipment, as here pictured, represents the last word in domestic electrical installation, for electric power is employed for every need and comfort—from a pumping plant to irrigate the vast estate to a hair-drying apparatus for the mistress' boudoir; from the utilitarian functions of laundering clothes and sweeping floors to the comfort of a circulating chilled-water system and the artistic effects of the concealed and indirect lighting which shows the tasteful interiors by night.

This home in the environs of Los Angeles is situated on the famous Santa Anita Ranch, well known to lovers of fine horses; but the fact that this home site was in the country did not mean that the heiress of "Lucky Baldwin's" millions was to be deprived of any of the advantages and conveniences of life in the city. Through the lines of the central-station company all the conveniences of the metropolis are conveyed to the estate, and as a result of the plans developed by Mrs. Baldwin and her architect, Anokia is probably the most completely equipped "electrified home" in the West.

Lighting of the Grounds and House

A most impressive feature, on first inspecting the place, is the lighting system both without and within. The illumination outside has been designed to bring out the architectural features of the house by night, and that in the interior to show off the mural paintings and carefully selected furnishings to best advantage.

The broad veranda and the double sets of stone steps leading to it are illuminated by means of twenty-five lighting standards of bronze, which are of exclusive design and so placed that the light will be caught by the white surface of the walls and arches.

An example of the indirect lighting used in the house is in the interesting "jinks room," where the use of urns suspended from the ceiling and containing the lamps produces a soft glow that brings out the colors of the frescoes, Oriental rugs and other objects of art. This hall, devoted to good cheer, is equipped with everything that goes to make a jolly and informal gathering, including an electric range in the adjoining "kitchenette." A variety of electric devices are used in the last-mentioned room for preparing impromptu suppers, while, in order to prevent the odors of cooking from going through the house, an electrically operated ventilating system is installed, with an exhaust fan which carries the fumes outdoors.

Refrigerating Equipment

The ice plant in the basement makes the estate quite independent of the vagaries of the local ice man. A 15-hp. motor operates the machine for three or four hours a day and not only produces about 400 lb. of ice

INDIRECT LIGHTING IN THE "JINKS ROOM," ANOKIA, NEAR LOS ANGELES, CAL.

but cools boxes with a capacity of 1500 cu. ft., which are kept at a temperature ranging from 33 deg. to 40 deg. Fahr. The drinking water, which is drawn cold from the taps throughout the house, is chilled by a separate system, utilizing a tank with brine coils for producing the proper temperature and a small electric pump for circulating the water.

The electric vacuum-cleaning system which extends throughout the house, the electric hair dryers in each dressing room, the complete electric laundry (in a building away from the house) where washing machines, wringers and irons are all electric in operation—these are the type of conveniences that one looks for in city mansions but which the transmission line now brings to the remote country seat as well.

The garage and repair shop contain electric equipment for the care of the automobiles. An unusual feature for a private garage is a vacuum-cleaning plant for the cars, a duplicate of the one used for sweeping and dusting the house. The shop is run by a 5-hp. motor, which operates the lathe, drill, press, grinder and other machinery that make the Baldwin garage independent of outside shops for large as well as small repairs.

Electric Irrigation for the Estate

Finally, the beauty of the home grounds and the fertility of the 6000-acre ranch are dependent upon the electrical pumping system. From a number of wells about the place water is forced into reservoirs and tanks for both domestic use and irrigating purposes. More than 200 hp. is represented in the motors installed at various points. A 40-hp. motor connected directly to a centrifugal pump is shown in one of the photographs. This is used for raising the water supply from one of the wells to a big concrete reservoir on an elevation 300 yd. distant. From the reservoir the water for domestic use is pumped to a filtering system and thence to an 1800-gal. tank.

In the past it has often been necessary for one with a taste for country life, a love of nature or a hobby for breeding choice stock to forego many of the comforts of modern life when retiring to a home out of town. Nowadays, through the agency of the countryside transmission network, it is possible to combine the quiet pleasures of a country estate with the luxuries that it was heretofore impossible for even the wealthiest to procure away from the cities. But as the rich man's plaything of to-day becomes the necessity of the average man of to-morrow, one may look forward to the time when the farmer's wife will expect many of the conveniences described above as a matter of course, and with the continued development of electric-power transmission and distribution throughout the country the use of electricity in rural districts may become as general as it is now in the great cities.

Advertising on Car Windows

By selling all the space in their cars to advertising companies, many combination railway and central-station companies deprive themselves of a medium of advertising that would be very valuable for their own use. A way out has been found by the Elmira (N. Y.) Light & Railroad Company, however, by the use of a frame which fits in one of the windows and which holds two cards, so that the message can be read by people on the street as well as by the passengers. The frames are set up in the middle windows of the car and used by the company in making announcements to the public. This form of advertising, the company states, is proving to be most effective and entails but little expense.

Merchandising Methods

Adjustable Chart to Show How Seasons Affect Lighting Bills

An interesting little device developed by the Cleveland Electric Illuminating Company and illustrated herewith is used to show customers why their electric-lighting bills vary with the seasons. The chart consists of a circular dial of cardboard on which are plotted in polar co-ordinates hours of night and day and the average amount of cloudiness observed for the various months of the year. Pivoted over the circular dial are two movable sectors, which can be set at the time of going to bed and adjusted to the number of hours of sleep, so that the visible part of the circular dial shows clearly the hours during which artificial light is required.

On the back of the chart are given directions for the use of the dials, the yearly average percentages of

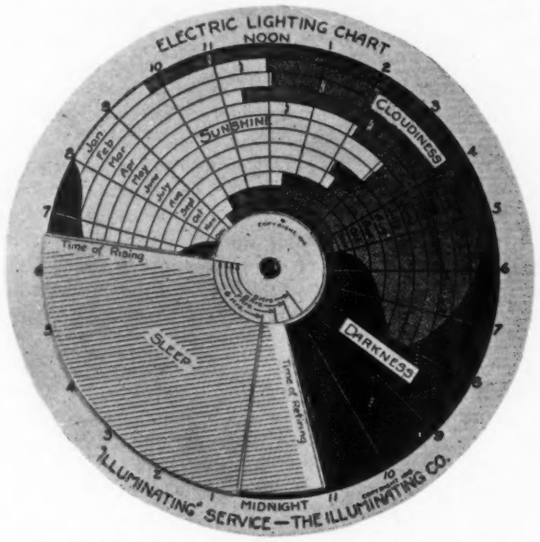
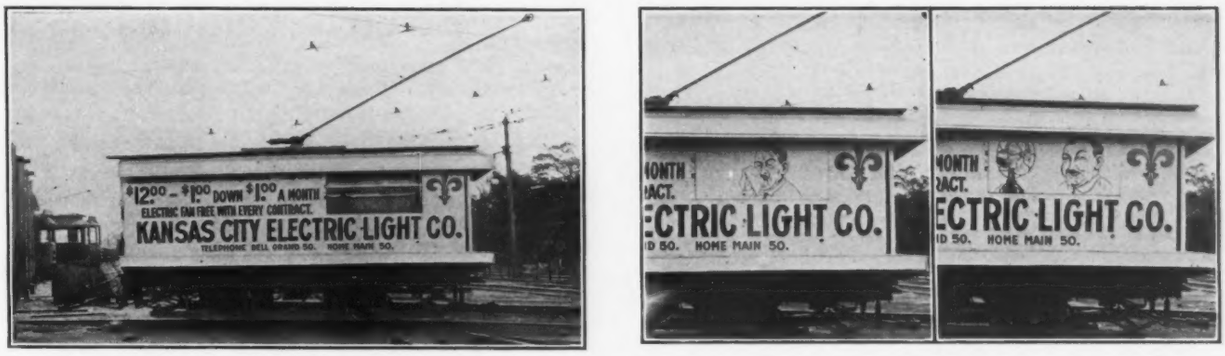


CHART FOR CALCULATING HOURS OF LIGHTING

darkness, cloudiness and sunshine, and also the principal weather statistics for the year in which the chart is issued. Mr. Mathias Turner, sales manager for the Cleveland Electric Illuminating Company, is responsible for the development of the idea.

Stock Motors Landed the Contract

When the National Aluminum Works became established at Elmira, N. Y., the company fully expected to continue, as formerly, in its use of steam power. Such expectations, however, were not to be fulfilled, for the Elmira Water, Light & Railroad Company, whose Madison Avenue plant is adjacent to the aluminum works, proved itself equal to the occasion. The electric company had a number of spare motors in its stock room, and at once suggested that they might be utilized to operate the machinery as it was installed. A bank of transformers was installed for the new works, and as fast as machines were put in place the spare motors were set up to operate them. Although these motors were not the proper size for the work, they served to demonstrate the versatility and power of electric energy and a wholesale contract was signed as soon as load tests had been made and specifications of the type, size and speed of various motors submitted. When the new motors arrived the stock motors were again consigned to the storehouse as good as ever.


$12.00 – $1.00 DOWN $1.00 A MONTH
ELECTRIC FAN FREE WITH EVERY CONTRACT.
KANSAS CITY ELECTRIC LIGHT CO.
TELEPHONE BELL GRAND 50. HOME MAIN 50.
ECTRIC LIGHT CO.
ECTRIC LIGHT CO.

THE KANSAS CITY ELECTRIC LIGHT COMPANY'S ADVERTISING CAR AND ITS CHANGEABLE ELECTRIC-LIGHTED SIGN

Advertising Twelve-Dollar House-Wiring Campaign at Kansas City

In preparation for the fall house-wiring season, the Kansas City Electric Light Company has had in service again this summer the advertising car which created something of a sensation two years ago. The feature of the display this year is a revolving double-faced sign, 2.5 ft. by 5 ft., inserted in the side of the car, operated by a flasher. The sign is reversed while the lamps which illuminate the sides of the car are momentarily extinguished, so that when the lamps flash up again the sign is seen to be changed. A motor in the car operates the flasher sign and a "hurdy-gurdy." The crew of the car consists of three men, the motorman, the conductor and the hurdy-gurdy attendant. The car covers about 30 miles each night, being on the streets two hours. It has eight different routes, which are covered in succession so that each section of the city is visited by the car about once a week.

Electric Irons in Cap Factory

The accompanying illustration, which shows a portion of a cap-making establishment in Brooklyn, N. Y., indicates how the Edison Electric Illuminating Company of Brooklyn makes profitable customers out of its small consumers. Nine four-heat electric irons, several sewing-machine motors and the lighting equipment are supplied with central-station service on a maximum-demand contract, the energy rate being 10 cents per kilowatt-hour for the first twenty-five hours' use of the maximum demand, 5 cents for the second twenty-five hours' use, and 3 cents for all in excess of 50 hours' use.

ELECTRIC IRONS IN A BROOKLYN CAP FACTORY

A Window-Display Kink

In Oregon City, Ore., the Huntley Brothers Company hit upon the idea of painting a huge tungsten lamp on the window, leaving the "lamp" transparent and the rest of the window opaque. A member of the firm reports that the idea was instrumental in selling 1000 tungsten lamps in ten days, although the little city has a population of less than 5000.

Service to the Passer-by

The manager of the Western Electric Company's supply depot at Newark, N. J., has hit upon an ingenious scheme for gaining closer touch with the man who stops to gaze into the window but will not come into the store. It is a telephone installed outdoors on the frame of the window. It communicates directly with an information desk placed in the display window itself in charge of a member of the selling force, who, in effect, is stationed there to serve all those who pause to observe the display.

The sidewalk telephone, as shown in the picture, speaks directly to the man in the window, who in turn is connected by his telephone to all departments and is able to secure all information desired in regard to prices or any other detail of interest to the passer-by. It is a unique innovation that has created much interest, and the outdoor telephone is in use much of the time. The window clerk takes orders for articles on display in the window, answers questions of every description, secures many names and addresses for the mailing list, and impresses every one who pauses before the window with the cheerful, up-to-the-minute service which this store affords.

REACHING THE SHOW-WINDOW SPECTATOR BY TELEPHONE

The Sign Habit

The Pacific Power & Light Company of Portland, Ore., recently conducted an electric-sign campaign that proved exceedingly successful. The company's territory was thoroughly canvassed by a visiting salesman from a sign manufacturer who spent eight months in this region, during which time eighty signs were sold with an aggregate number of 5404 lamps.

A special inducement was offered permitting a long period for payment on the signs. Special sign contracts were made, and the rates for service, cost of sign, hanging, interest, etc., were all figured in the price and prorated over a certain period of months, the period depending on the credit of the prospective customer. In many cases the time went as long as sixty months, but where the credit was not so good the time was cut down according to the judgment of the local manager, who had to pass on all credits.

The company's new-business manager writes:

"Since the campaign has been completed and Mr. Conover (the sign salesman) gone, we find that our sign business continues to keep up remarkably well. Every month we receive several new sign contracts, and I believe that this is purely the result of the campaign. In other words, we have got the people into the sign habit.

"There were several points about this campaign which were very gratifying. The principal one was that it was put on at practically no expense to us, yet at the same time it brought us in a fine amount of business and has given a great stimulus to outdoor illumination, the effect of which will not wear off but will be the source of continued growth in this branch of our business."

Developing Local Industries as Future Central-Station Loads

Working on the principle that the interests of a public utility and the community it serves are identical, W. S. Barstow & Company, who control some forty-odd utilities in New England and the Middle West, have instituted an industrial department the purpose of which is to assist these communities in attracting industries within their borders. Working arrangements have been made with the chambers of commerce in these places by means of which the company will co-operate with the local bodies in their efforts to develop new industries. Data relating to vacant or unused factory buildings, sites, etc., are now being gathered throughout the territory served. The industrial department is in charge of Mr. Arthur M. Torrey, formerly with Hildreth & Company, New York, who also looks after the engineering contract department of the company.

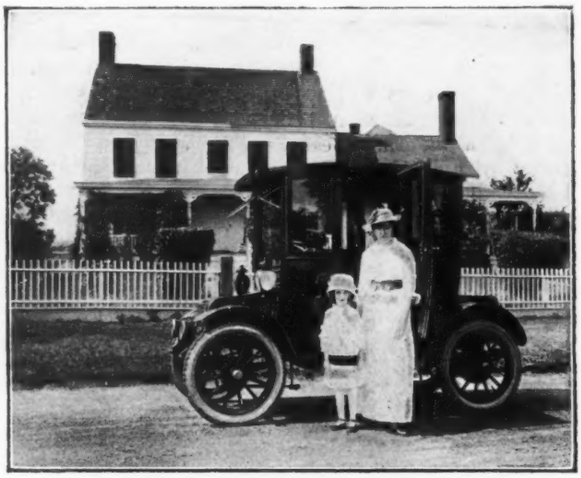
Co-operation in Little Rock

A high degree of co-operation exists between the electrical contractors of Little Rock, Ark., and the Little Rock Railway & Electric Company. Two years ago there were but three contractors in the city, and little attempt was made by them to get the apparatus trade. There are now five contractors in Little Rock, all largely interested in selling electric appliances of all kinds. The company is consulted on the purchase of all appliances, and by its recommendation has kept all appliances installed up to a high standard. Each morning at the salesmen's meeting in the commercial department of the railway and electric company there are one or more of the contractors present with a view of securing business or assisting in closing some new contract.

Electric Vehicles

The Passenger Vehicle's Progress in New York and New England

Although the electric passenger car has attained its widest use in the cities of the Middle West, the convenience and simplicity of electric locomotion is already winning for the battery-driven vehicle its rightful place among means of transportation in the more conservative East—particularly for the woman. In New York City and the great suburban area which surrounds it "electrics" are making a rapid drive for popular favor. On the island of Manhattan alone, according to figures issued by the New York Edison Company, about seventy-five women now drive their own electric cars. Many of these women take their cars with them to their summer homes. No other type of vehicle, it is pointed out, enables the woman and the members of her family to enjoy shopping trips, calls, and spins through the park and along suburban roads, and to arrive at the destination as fresh and spotless as at the start of the trip. The accompanying illustration shows the advent of twentieth-century transportation and comfort in a century-old Connecticut homestead, whose hospitable porch has doubtless witnessed the passage of state coaches on the well-seasoned road now so admirably adapted for electric touring.



COUNTRY LIFE DE LUXE IN CONNECTICUT

Electric Trucks Economical Even Under Low Daily Mileage Conditions

According to the experience of the Duquesne Light Company, Pittsburgh, Pa., electric trucks have proved especially desirable in central-station service where the daily mileage traveled is small. The trucks employed by the Duquesne company are required to traverse less than 16 miles per day per truck, which is equivalent to about 4000 miles a year. This condition makes the item of fixed charges an important factor when compared with the cost of hiring vehicles.

The accompanying table shows the cost of operating trucks for the distribution department of the Pittsburgh company. The operating cost includes repairs and improvements in equipment. The fixed charges are based on 12 per cent for electric vehicles and 18 per cent for gasoline trucks. Comparison of the total expenses shows an advantage for electric vehicles over

horse-drawn or gas-driven trucks, especially when the vehicles are garaged by the company. In one district the average cost of hiring wagons was $375 a month as compared with $137 when one electric truck was placed in service. The truck gave about the same service as one and one-half wagons at $160 a month

COST OF OPERATING TRUCKS

Truck	Cost per Day		Total	Remarks
	Operating	Fixed Charges		
Gasoline	$3.66	$1.67	$5.33	Garaged by company
Gasoline	3.09	1.60	5.50	Garaged by company
Gasoline	2.06	0.90	2.96	Rented
Electric	4.71	0.29	5.00	Thirteen years old, rented
Electric	3.24	1.15	4.39	Rented
Electric	0.96	1.00	1.96	Garaged by company
Electric	2.00	0.89	2.89	Rented
Electric	1.76	0.89	2.65	Rented
Electric	1.13	0.89	2.02	Garaged by company
Electric	0.71	0.89	1.60	Garaged by company
Electric	0.69	0.89	1.58	Garaged by company

Costs per mile: Gasoline trucks, 26 cents; electric trucks, 22 cents; hired team, 80 cents. Drivers' wages for only two hours a day are charged to operation, since the driver works in the gang while the truck is standing.

each. The saving was therefore the difference between $238 and $31 (the monthly cost of operating the truck), or $207 a month. Because of the higher speed attained with these vehicles it was also found that the gang could do 27 per cent more work, so that $4.05 per day was saved on wages.

The Versatility of the Electric Truck

Aside from its usefulness as a dependable means of locomotion, the electric truck, unlike any other kind of vehicle, is itself a sort of perambulating power plant or portable source of electrical energy, which can be drawn upon for the operation of electrically driven devices of almost any kind. Physicians, for example, have found their electric phaetons particularly useful when called

THE TRAVELING MACHINE SHOP OF THE PHILADELPHIA ELECTRIC COMPANY

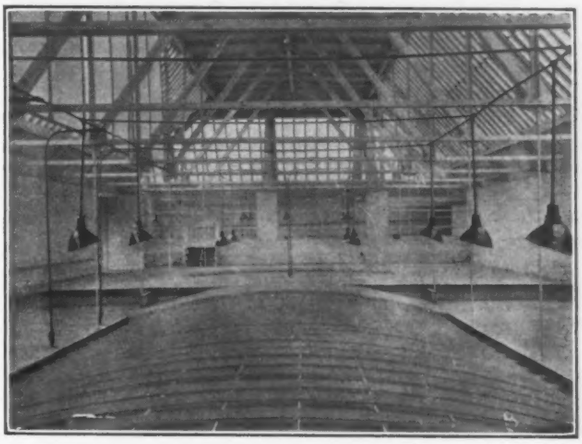
upon to make X-ray diagnoses in the homes of patients where electric service is not available. By running a pair of wires to the battery of the vehicle standing at the curb, the doctor's portable X-ray machine can be operated as conveniently as if connected directly to the central-station circuits.

The illustration herewith shows a portable motor-driven pipe-threading and cutting machine which is operated from the cells of the truck battery near by. This outfit is used by the Philadelphia Electric Company. The truck hauls the portable tool shop to the work and then supplies energy to operate it during the day.

Interior Construction

Nitrogen-Filled Lamps in Boston Art Museum

The illumination of the newly opened Robert Dawson Evans wing of the Boston Museum of Fine Arts is perhaps of a more advanced type than can be found in any



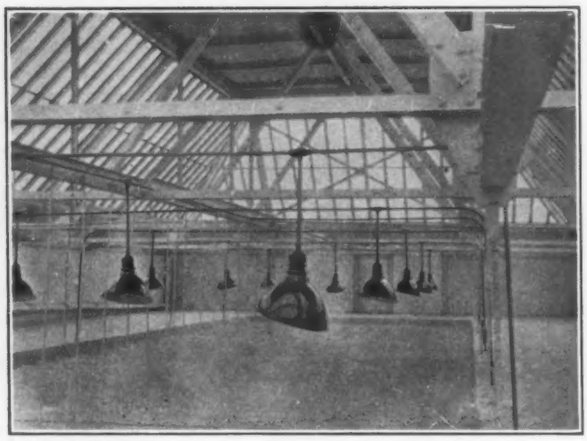
LIGHTING OF NORTH GALLERY OF EVANS WING—BOSTON MUSEUM OF FINE ARTS

similar picture-gallery lighting installation in the world. Nitrogen-filled lamps of 750 watts rating each are used in a system of illumination through ceiling windows, the lamps themselves being installed in the high attic spaces above the galleries. To bring out the full tone of the pictures and to minimize the glare, so common with fresh oil paintings, the necessity of a well-diffused system was recognized. The installation here described provides a well-diffused system of cross-lighting with no direct rays penetrating the glass ceilings.

The two large end galleries in the Evans wing have flat ceiling windows. The galleries, which run laterally, as well as the corridors connecting with a series of smaller rooms, have arched ceiling windows. All ceiling glass is $\frac{3}{8}$-in. ground plate, which is said to possess the best light-diffusing qualities. To exclude direct sunlight, sets of hinged frames, on which is stretched white cotton cloth and which are operated from the corridor below by compressed air, are installed over each of the ceiling windows. The entire interior of the attic space is painted white.

Conduit Construction Throughout

Over the two end galleries referred to, which measure 80 ft. 9 in. by 36 ft. and are 32 ft. high, the 750-watt nitrogen-filled units, in 15-deg. Wheeler metal reflectors, green outside and white enamel within, are installed 4 ft. above the flat glass ceiling, which measures 63 ft. by 19 ft. The lamps are suspended on sections of 0.5-in. galvanized conduit, about 15 ft. on centers, in two rows 17 ft. 6 in. apart. In addition, a lighting unit is installed at each end, between the two rows. The lamps within the reflectors are vertical, and the deflection of the reflector is in the direction of the wall opposite the side on which the lamp is placed.



ILLUMINATION OF THE EAST AND WEST GALLERIES

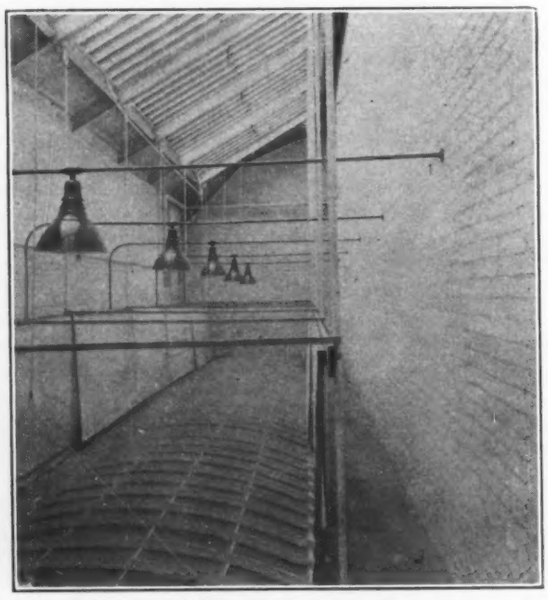
Two north galleries, each 34 ft. by 56 ft., have arched ceiling windows 17 ft. 8 in. by 41 ft. 8 in. at a height of 30 ft. above the floor. Above these windows the lamps are 11 ft. apart in two rows 15 ft. apart. These units are equipped with 20-deg. reflectors, facing inward.

Illumination of Smaller Galleries and Corridor

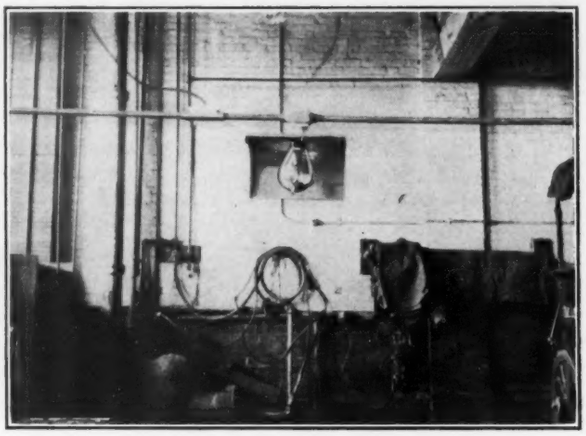
Two smaller galleries, in line with the two last mentioned and each 34 ft. square and 29 ft. high, are lighted through round ceiling windows, 17 ft. in diameter, by gas-filled units in vertical Wheeler reflectors hung about 4 ft. above the ceiling. The south side of the wing is provided with a similar lighting installation.

A 10-ft. corridor runs the length of the wing between the two series of galleries. It has an arched ceiling window about 7 ft. wide, over which the 750-watt lamps are mounted in a single line, 18 ft. between lamps and 6 ft. above the crown of the glass. In the entire building sixty of the high-efficiency lamps are installed.

The galleries are closed before dusk for the greater part of the year, but during the winter artificial lighting is required for an hour or two in the late afternoon, especially on Saturdays and Sundays, when closing is at 6 p. m. The total duration of lighting is about 180 hours in a year.



CORRIDOR LIGHTING—BOSTON ART MUSEUM



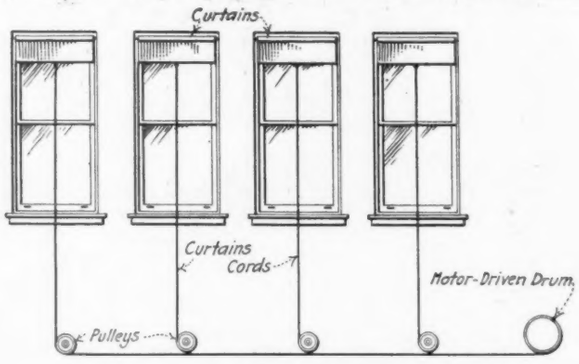
MOVABLE FIXTURE FOR LIGHTING CAR-WASHING STAND

Drop-Lighting Fixture for Garage Service

For car-washing service in garages the apparatus available for lighting the sides and under portions of automobiles is frequently very cumbersome. A flexible installation which eliminates the heavy equipment sometimes used is illustrated herewith. It was designed by the Lowell (Mass.) Electric Light Corporation for use in the company's electric-vehicle garage, and consists of a set of four 150-watt lamps mounted in 10-in. by 12-in. Frink reflectors carried on condulet fittings attached to a 0.5-in. conduit 16 ft. long. A flexible lead feeds the several lamps in multiple, and the entire outfit is easily raised and lowered by small ropes and pulleys. Weight was saved by avoiding the use of a continuous reflector inclosing all the lamps.

Lecture-Hall Window Curtains Drawn by Motor

Window curtains in the lecture hall of the physics building at the University of Michigan, Ann Arbor, are operated by motors controlled from the lecture platform. This method has been provided since sometimes as many as eight lectures requiring a darkened room are delivered in a day. The curtain rollers are similar to ordinary spring rollers except that the ratchets and pawls are omitted, and the curtain cords are used to prevent the springs from rolling up the curtains. The cords run through openings in the sill and are attached



RAISING AND LOWERING SHADES BY MOTOR

to drums driven by motors. The control switches are mounted in the same cabinet with the lamp switches. The friction of the pulley mechanism is sufficient to prevent the springs from raising the curtains when the motor is de-energized. One motor operates several curtains.

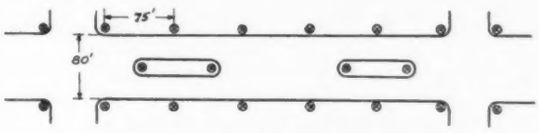
NIGHT AND DAY VIEWS OF NITROGEN-FILLED TUNGSTEN ORNAMENTAL LIGHTING AT ROCKVILLE CENTER, N. Y.

Lighting Practice

Gas-Filled Ornamental Lighting at Rockville Center, N. Y.

BY A. L. POWELL

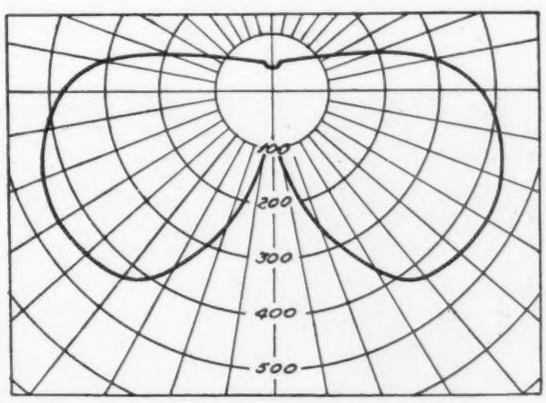
Although a five-lamp tungsten-lamp system had been previously installed on certain streets of Rockville Center, Long Island, N. Y., when it was decided to equip other streets of the town last fall plain single-lamp



ARRANGEMENT OF LAMP STANDARDS

standards with nitrogen-filled lamps were selected. Because of the curvature of the roads, large, high trucks coming up to the curbing would frequently damage the five-lamp standards. Besides the distribution advantages afforded, it was felt that the one-lamp standards would be decidedly less expensive to keep in repair.

The globes of the new system are mounted 15 ft. above the curbing and are made in two parts. The bottom part is of clear glass, roughed inside, while the top is of very dense opal which has not been polished. Although a considerable amount of light is thus reflected downward, a certain amount is diffused upward to



DISTRIBUTION CURVE OF LAMP UNIT

illuminate the building fronts. Each lighting unit is a 400-cp., 5.5-amp. series gas-filled Edison Mazda lamp. The standards are opposite each other on 120-ft. centers.

The cost of installing the fixtures and wiring was met by assessments on the owners of abutting property at a fixed value per foot front, in addition to contributions received from public-spirited citizens of the village.

Since the system has been installed many more people have been seen nightly on the newly lighted streets. Keepers of stores fronting on these streets, who in large part paid for the system, are positive that the investment is bringing large returns. The installation was made under the supervision of Mr. H. C. Major, superintendent of the local lighting plant.

Lamp Trimmer's Ladder

No pedestrian, be he superstitious or not, can walk beneath the lamp trimmer's ladder used by the boulevard-lighting department of the South Park Commissioners, Chicago, for the ladder's base is set firmly against the post on which the trimmer is working and the ladder itself leans outward, suspended at its top by an iron hook. This hook holds the upper ladder rungs at a convenient distance from the lamp globes and is locked in place around the standard by a pin and chain. The trimmer while ascending the ladder and while working on the lamps remains at all times between the ladder and the post.

Such a ladder possesses several advantages over the ordinary ladder. It is, for example, impossible for such a ladder to slip; it presents practically no

LAMP-TRIMMER'S SAFETY LADDER

obstruction to pedestrian traffic, which, in Chicago's downtown district, is always dense; it places the trimmer in a convenient position for working, and it minimizes the hazard to both the public and the trimmer.

Artificial Illumination, Architecture and Decoration

Mr. David Crownfield, chief fixture designer for the Pettingell-Andrews Company, Boston, Mass., emphasized the close relationship which should exist between architect, engineer and fixture designer at a recent meeting of the New England Section of the Illuminating Engineering Society.

Among the most beautiful examples of a type of outlet layout which is almost universal in Europe, said Mr. Crownfield, is that in the Galleria Collona, at Rome. The arrangement consists of a double row of crystal chandeliers running parallel to the long axis of the room and spaced from one-fourth to one-sixth of the width of the room from the side wall. This arrangement accentuates the length of the room, and the use of three divisions enhances the artistic effect as compared with a single line of pendants. In this gallery the pendants are hung in front of the windows, an unusual arrangement which incidentally facilitates the distribution of daylight by reflection from the facets of the crystals as well as the dispersion of artificial light. The location of the fixtures between the windows keeps the paintings from being obstructed. The sources of light are also so far away from the canvases that light is not picked up and reflected by thickly applied paint.

Analysis of Existing Installations

The author also discussed a number of lighting installations in the Copley-Plaza Hotel, Boston. In these the fundamental effort has been to provide fixtures appropriate to the decorative schemes and in close harmony with the periods represented in the various rooms treated. Thus the lantern type of fixture has been effectively used in portions of the hotel as a concession to the historical sense. In using lantern fixtures electric candles are essential, but the efficiency of the unit is entirely dependent upon the light-distribution curve of the lamps. Cove lighting is used in the barroom. The results are fairly satisfactory, although the low barrel ceiling, vaults and shadows on the molding, and surface decorations do not distribute the light with the best efficiency.

The lighting of the ladies' tea room, on the other hand, is remarkably satisfactory. The room was laid out with a diffusing glass ceiling, behind which are electric lamps covering almost the entire area beneath with an artificial daylight effect. Along two sides of the room are heavy beams supported by columns. Electric outlets are placed on these beams midway between the columns, and from these depend modern fixtures hanging well down into the room. The results of cooperation between engineer, designer and architect are most satisfying in this case.

Lighting of College Library

The John Hay Memorial Library, at Brown University, Providence, R. I., was the first building in the world to be illuminated throughout by the indirect method, continued Mr. Crownfield. Every college library has to meet heavy demands as term ends approach, often by the addition of extra tables. On account of the inflexibility of standards when provided for fixed table arrangements, lighting from overhead was selected, the light rays being crossed to avoid dark spots. The outlets are in alternate bays of the ceiling, thus also putting a portion of the ceiling in shadow, which is restful to the eye when looking up from books and papers. The reading-room is lighted with indirect units at one-third the energy expenditure assigned for direct table lighting.

"White-Way" Lighting at El Paso, Tex.

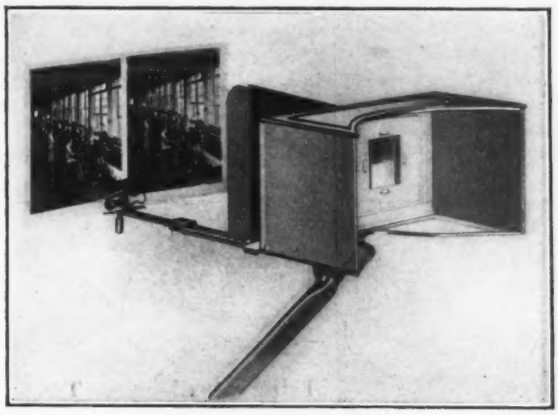
The El Paso (Tex.) Electric Railway Company has recently completed half a mile of "white-way" lighting on San Francisco Street, El Paso. The installation consists of forty-six ornamental inverted magnetite arcs of the 4-amp. type, mounted on steel combination trolley and lighting poles. Standard-weight 35-ft. steel poles measuring 5 in., 6 in. and 7 in. in section were used for this purpose, the poles being set 6 ft. in concrete. The poles are spaced 90 ft. apart and are staggered, thus placing lamps at intervals of 45 ft. along the street. The 4-amp. arcs are so mounted as to bring the center of the arc 16 ft. from the curb, and with this height and the 90-ft. spacing a very even lighting over the entire street is obtained. Overhead distribution is employed, a special pole top and break-arm being employed to carry the arc circuit. The construction work was done by the light and power department of the El Paso Electric Railway Company, the electrical equipment was furnished by the Southwest General Electric Company, and the poles and brackets were furnished by the Electric Railway Equipment Company.

MAGNETITE-ARC "WHITE WAY" LIGHTING ON SAN FRANCISCO STREET, EL PASO, TEX.

NEW APPARATUS AND APPLIANCES

A Stereoscopic Aid for the Electrical Salesman

An optical device embodying the principle of the old-fashioned stereoscope, which should be made of much selling assistance to salesmen for central-station service and for manufacturers of electrical apparatus and devices too large to be shown to the intending purchaser except by picture, has been developed by the Corte-Scope Company of Cleveland, Ohio, and is called the "Corte-Scope." The device is of light but sturdy construction and puts the old-time stereoscope into a form that is practical for commercial purposes. The aluminum instrument when folded occupies space about the size of a man's hand and is used in viewing binocular photographs. Such a photograph viewed through the lenses looks not like a picture but like the actual object itself. Indeed, one almost feels the impulse to reach out and operate the mechanism.



POCKET STEREOSCOPE FOR THE ELECTRICAL SALESMAN

The device as a business increaser is being applied in many ways. It is being used to show details of construction, for instance, and the arguments thus presented are very convincing. It enables the salesman of a company selling machinery or heavy articles virtually to carry all his samples in his coat pocket, and besides samples he can in effect show whole plants to any new or prospective customers.

The great advantage of the stereoscope pictures over ordinary "flat" pictures of any kind lies in their vividness and realism. Before any sale can be made, it is pointed out, the salesman must have the customer's full attention. The striking effect of these pictures secures that attention from the start, while the detail of the picture dispels any doubt as to the truth and accuracy of what is shown.

Automatic Pipe Wrench

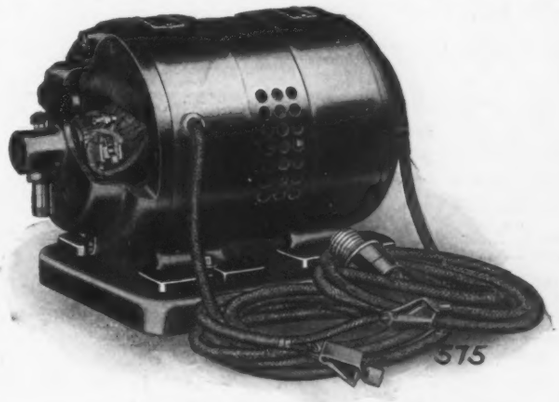
The pipe wrench shown in the accompanying illustration is so linked that no adjustments are required for different sizes of pipes, and the greater the force with which the operator presses on the handle the greater is the pressure tending to grip the pipe. The wrench has a quick-release and ratchet movement and, according to the manufacturer, the Hayward Wrench Company, 700 Cass Avenue, St. Louis, Mo., is strong and durable. It is of high-carbon drop-forged steel and is made in three sizes—one 7 in. long, another 11 in. long and another 14 in. long, with jaw openings respectively 1.15 in., 1.375 in. and 1.875 in. The weights are 11 oz., 1 lb. 14 oz. and 3 lb. 6 oz. respectively.

SELF-ADJUSTING PIPE WRENCH

Battery-Charging Sets

For charging automobile and motor-boat batteries the Robbins & Myers Company, Springfield, Ohio, has developed the motor-generator set shown in the illustration. These sets are built to operate on 110-volt and 220-volt direct-current energy, or on 115-volt and 230-volt, sixty-cycle alternating-current energy. For use in private garages a 80-watt size has been developed. This size will sometimes be convenient for public garages where the service is light and where not more than one battery has to be charged at a time, but the 150-watt and 250-watt sizes are in general recommended for public-garage service.

The 80-watt and 150-watt outfits can be easily moved about and are fitted with oak bases to enable them to be placed on the running board of a car without marring the finish. The 250-watt size is designed for permanent installation in a garage. The 80-watt, 8-volt outfits will charge one 6-volt battery, starting at a 10-amp. rate. The 150-watt outfits are for either 15-volt or 30-volt operation, and the 250-watt outfits for 30-volt operation.



MOTOR-GENERATOR SET FOR BATTERIES

The 80-watt and 150-watt sets are furnished with 10 ft. of heavy duplex cable equipped with universal test clips on the generator end, the leads being substantially anchored to the frame of the machine. The 250-watt sets have leads brought out of the frame through bushed holes. These leads are equipped with brass connections at their ends. Four leads are provided, two of them being for connection to a field rheostat. Wick oilers are provided on the two smaller outfits and ring oilers on the larger.

The motors can be attached directly to lamp sockets or other convenient terminals, no starting resistance being required. As the generators are shunt-wound, either clip may be connected to either terminal of the battery, the generator adjusting its polarity automatically to that of the battery. After the battery becomes fully charged the generator may be left floating on the battery without injury.

Screw-Plug Flush Receptacle

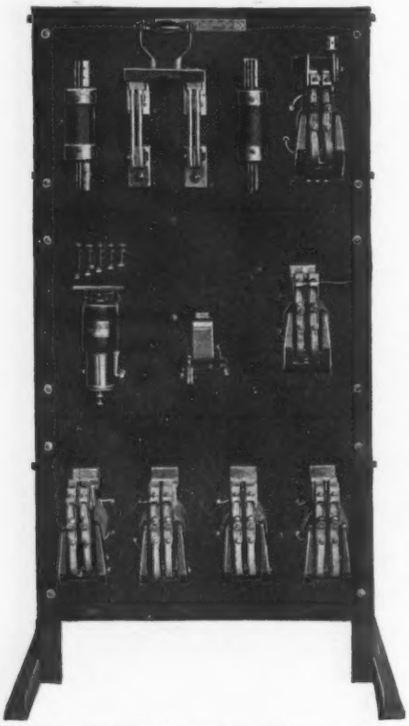
A screw-plug receptacle with flush plate has been added to the wiring specialties of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. This receptacle is designed to be placed in a wall or baseboard for

SCREW-PLUG FLUSH RECEPTACLE

use in connection with table lamps, fans, heating appliances, etc. Its rating is 660 watts at 250 volts. A spring contact is provided in the receptacle to insure good contact even in places where there is jarring or vibration. These receptacles are made with and without hinged lids, which can be closed when the receptacle is not in use.

Automatic Starter with Adjustable Acceleration Device

An automatic starter in which the time of acceleration can be varied over a wide range by adjusting the air dash-pot of the automatic starting solenoid has recently been placed upon the market by the Industrial Controller Company, Milwaukee, Wis. In this starter the various steps of the resistance are cut out by separate magnetic switches which are controlled by a master switch. All switches have removable stationary and movable contacts, and copper brushes are used as energy-carrying contacts. The design of the switches is such that the magnet coils and all wearing parts can be removed from the front of the panel. The various switches are controlled by means of contact figures engaging with the contact bar of the solenoid-operated master switch, thus avoiding all mechanical interlocks.



CONTROL PANEL SHOWING ACCELERATION SOLENOID AND AUTOMATIC SWITCHES

Ventilated Fixture for Gas-Filled Lamp

Lighting fixtures for both exterior and interior use and designed for taking gas-filled lamps have been placed on the market by the Pittsburgh Metal Spinning & Stamping Company, Pittsburgh, Pa. These fixtures are provided with "Mogul" sockets and also serve as shade holders. The arrangement for attaching the socket and the ventilating cap is such as to make the fixture weatherproof. Under test no part of the lamp fixture reached a higher temperature than 221 deg. Fahr. The fixtures are artistically designed, those for

COMBINED FIXTURE AND SHADE HOLDER FOR GAS-FILLED LAMPS

exterior use being made entirely of copper while those for interior use are made of flemished bronze or brushed brass. The fixtures can be supplied in various sizes for taking lamps of from 100 watts to 1000 watts rating.

Flaring-Type Steel Reflector

A 14-in. flaring-type porcelain-enameled steel reflector has recently been placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn. The reflector has been developed especially for use with 60-watt short-base tungsten lamps. The neck is so designed that when the lamp is inserted in the socket the filament is

PORCELAIN-ENAMELED STEEL REFLECTOR OF FLOWING TYPE

in the proper position to secure a maximum diffusion of light. The device is equipped with a contractile collar, made by the above manufacturer, permitting it to be attached directly to the socket, thus eliminating the necessity of separate shade holders. Ample ventilation is provided by vents in the top of the neck.

Traveling-Grate Stoker with Revolviug Disk Grate Bars

Automatic stokers of the traveling-grate type equipped with revolving disks in place of chains or grate bars, in order to allow good draft without danger of melting parts of the grate, are being manufactured by the Keystone Stoker Company, Boston, Mass. The grate surfaces of these stokers are composed of closely spaced

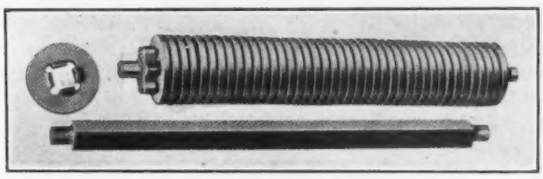


FIG. 1—GRATE BAR, SHOWING ONE DISK AND COMPLETE UNIT

disks mounted on parallel square bars which rotate as they move through the furnace. The disks do not mesh, and they make two or more revolutions during one passage through the furnace, thereby causing the disks to be cooled by the air currents entering the fuel bed. As a result the manufacturer claims that the disks have no tendency to melt and that the fire is gently agitated in a way which aids combustion and prevents mass formation of the clinker.

The links are made with flat bottoms which enable them to ride on the rollers with a minimum amount of friction. Each link carries an umbrella-shaped shield cap which protects it from the fire, the shields being held in place by dovetailing into grooves in the link. These shields form the upper half of the bearings of the bars carrying the disks and afford a quick means of replacing the bars by slipping them out of the links.

A simple, positive method of rotating the bars while in the furnace is effected by pinions fitted to one end of the bars and engaging with rack teeth suitably spaced along the bearer bar, which is also fitted with the rollers that support the links as shown in one of the illustrations. The freshly supplied fuel that sifts into the ash pit is reclaimed by falling on an apron and being carried forward by the returning disks onto a foot plate at the front, as shown in the section of the stoker.

The coal enters under a gate which regulates the proper fuel supply with the adjustment to vary the speed of travel made by two thumb-screws. Circulating water

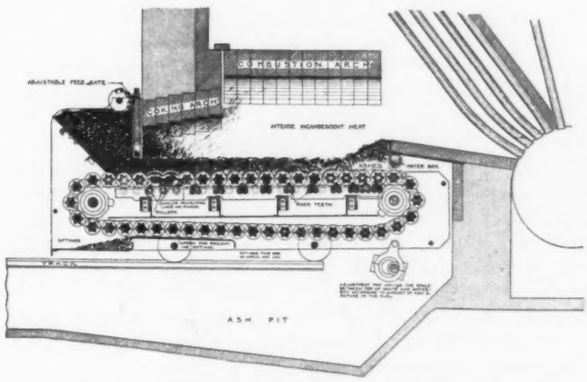


FIG. 2—METHOD OF REVOLVING DISK GRATE BARS

boxes are provided at the feed gate and at the bridge wall to prevent fires occurring in the coal hopper and damage to the bridge wall. Dumping grates at the rear are eliminated, provision for raising or lowering the back end being provided by strong eccentrics which jack the stoker to suitably thicken the fire at this point. In this way an excess of air through what would otherwise be the thin portion of the fire is prevented.

Since the fire disks revolve, the tendency for clinkers to stick to the grate is avoided, with the result that there is no serious plugging of the air spaces. The continual movement of the grate keeps the fuel even and in a free state, with the result that high draft pressure is not necessary to develop high rates of duty. The fuel disks and shields are common castings, so that the renewal expenses are low.

Attachment Plug

An attachment plug which, it is claimed, reduces the time of wiring to half of that required with other types of plugs has been developed by the Best Electric Company, Pittsburgh, Pa. This plug is equipped with a new strain-relief device which the manufacturers claim takes the full stress of any pull or jerk on the wire, thus eliminating the necessity of a knot in the wire. In wiring, both wires are cut even and there is no necessity for fishing in holes for the lead-in wires. Only one screw has to be removed in order to render the interior of the

ATTACHMENT PLUG OF ASBESTOS COMPOUND

plug accessible for wiring. An asbestos compound which, it is declared, cannot crack or melt is the material used in the construction of the plug.

Portable Triple-Scale Electric Tachometer

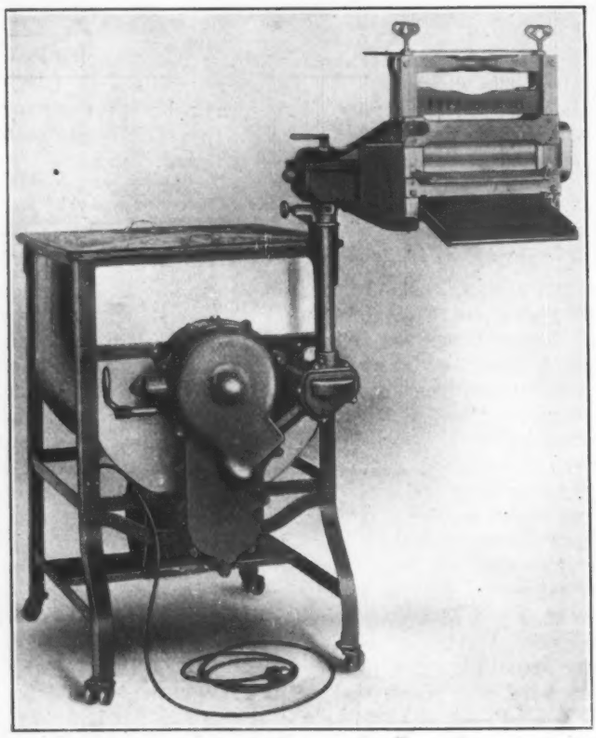
An electric tachometer consisting of a direct-current magneto and a millivoltmeter of the D'Arsonval type has been developed by the Electric Tachometer Company, Perry Building, Philadelphia, Pa. The magneto is connected in series to the meter by a twin conductor which may be 5 ft. or 10 ft. long as desired. The coil is provided with nickel-plated open terminals. The magneto is equipped with two cases as shown in the accompanying illustration, one being utilized for the gearing and the other for the magneto proper. The two chambers are separated by a solid metal wall, preventing oil and grease from entering the space containing the electrical parts. A strong and simple gear-shifting arrangement is provided which makes it possible to obtain three different spindle speeds in the ratio of 1, 4 and 16, while the armature speed is constant. The millivoltmeter is provided with three scales, the ratio of which is 1 to 4 to 16. Polished aluminum castings are used throughout. The gears are of case-hardened carbon machinery steel and phosphor bronze, and all shafts and spindle

bearings are provided with phosphor-bronze bushings. The shaft and spindles are of high-carbon steel. Ample provision is made, it is declared, for occasional lubrication. The millivoltmeter is of the horizontal portable type and is equipped with a mirror scale and knife-edge pointer. It is mounted in a carrying case of maple which is provided with lock and leather strap, hinged cover and reinforced corners. The tachometer may be provided with sets of scale ranges reading up to 12,000 r.p.m.

PORTABLE MAGNETO-OPERATED TACHOMETER

Electric Washer with Inclosed Gearing

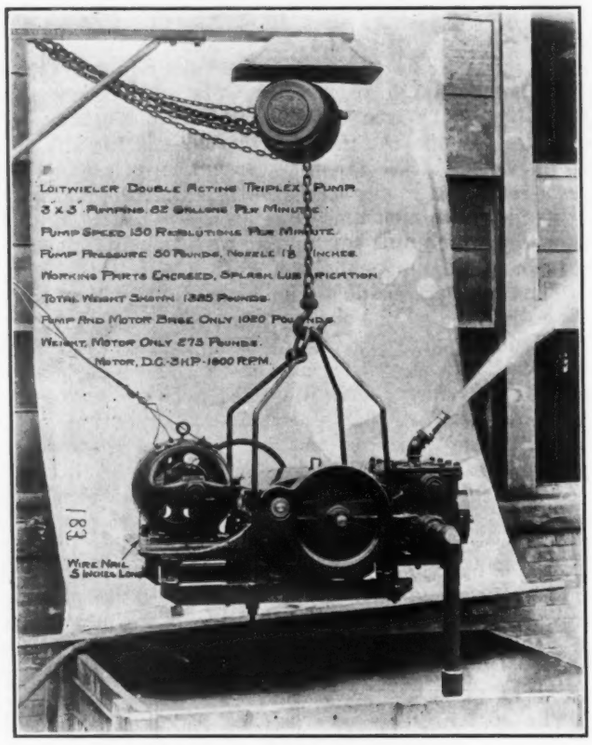
An electric washer in which all gears and other moving parts are inclosed in oilproof cases for the protection of both operator and clothes has been developed by the Pittsburgh Gage & Supply Company, Pittsburgh, Pa. The washer is of the cylinder type, the clothes being placed in a perforated cylinder which revolves and is automatically reversed at frequent intervals. Rigid construction is employed throughout, the tank being made of heavily tinned copper and the operating mechanism being heavy enough to preclude all possibility of stripping the gears. A Westinghouse 0.25-hp. motor is used to operate the washer and the wringer separately or simultaneously.



CYLINDER-TYPE ELECTRIC WASHER

Electrically Driven, Non-Vibrating Pumps

The non-vibrating qualities of the Luitwieler non-pulsating, motor-driven pump are well shown in the accompanying illustration, where a 5-in. wire nail set standing on end on the base of the suspended machine remained motionless while the machine was in operation. The pump is 3-in. by 3-in., double-acting, and is driven by a 3-hp., 1600-r.p.m. Rochester motor, gearing being employed to reduce the pump speed to 160 r.p.m.


LUITWIELER DOUBLE ACTING TRIPLEX PUMP
3 X 3 PUMPING 82 GALLONS PER MINUTE
PUMP SPEED 150 REVOLUTIONS PER MINUTE
PUMP PRESSURE 50 POUNDS, NOZZLE 1⅛ INCHES
WORKING PARTS INCASED, SPLASH LUBRICATION
TOTAL WEIGHT SHOWN 1385 POUNDS
PUMP AND MOTOR BASE ONLY 1020 POUNDS
WEIGHT, MOTOR ONLY 275 POUNDS
MOTOR, D.C. 3 H.P. 1600 R.P.M.
WIRE NAIL 5 INCHES LONG
183

NON-PULSATING, MOTOR-DRIVEN PUMP

At this speed the pump is capable of pumping over 82 gal. of water per minute at 50 lb. pressure. There are no air chambers in these pumps, 1-in. nozzles being employed in their place. There are six suction and six discharge valves. All working parts are inclosed under a cover which keeps out dust and dirt. Lubrication is accomplished by means of the splash system, chains bringing the oil up from the reservoir to the driving shaft and the pinion shaft of the pump. A groove at the outer end of the bearing and a drain hole return the oil into the reservoir so that no oil works out at the end of the bearing.

The cam shaft is of the floating type and is subject to no pressure at opposite sides in the cam-shaft bearing, thus reducing friction to a minimum. Tests are said to have shown the efficiency of the pumps to be 87.5 per cent. The pump illustrated was successfully operated at 300 r.p.m. when it was resting upon two 2-in. polished steel rollers, the manufacturer claiming that the speed of the pump seems to be limited only by fluttering due to high speed, which prevents the pump from seating itself properly. The maker is the Luitwieler Pumping Engine Company, Rochester, N. Y.

CURRENT NEWS SECTION

Program of International Engineering Congress

The program for the International Engineering Congress of 1915, which will convene in San Francisco during the week beginning Sept. 20, has just been completed. All sessions will be held in the New Civic Auditorium, and the program includes papers under the following classifications: The Panama Canal, waterways (four sessions), irrigation (four sessions), municipal engineering (five sessions), railway engineering (five sessions), materials of engineering construction (five sessions), mechanical engineering (six sessions), electrical engineering (three sessions), mining engineering (three sessions), metallurgy (five sessions), naval architecture and marine engineering (seven sessions), and miscellaneous (four sessions), including aviation, refrigeration, agricultural engineering and engineering education, heating and ventilation. Over 3000 members have already been enrolled.

The papers to be presented at the electrical engineering sessions are as follows:

"Economics of Electric Power Station Design," by Dr. H. F. Parshall, London, England.

"The Water-Power of Sweden," by Mr. Sven Lübeck, Stockholm, Sweden.

"Electric Power in Canadian Industry," by Mr. Charles H. Mitchell, Toronto, Canada.

"Industrial Effect of Low Cost of Electric Energy," by Mr. L. A. Ferguson, Chicago, Ill.

"The Effect of Hydroelectric Power Transmission Upon Economic and Social Conditions," with special reference to the United States of America, by Mr. Frank G. Baum, San Francisco, Cal.

"Electrical and Mechanical Installations of the Panama Canal," by Mr. Edward Schildhauer, New York, N. Y.

"Electric Welding," by Mr. C. B. Auel, Pittsburgh, Pa.

"The Application of Electricity to the Heating of Metals," by Dean F. L. Bishop, Pittsburgh, Pa.

"The Electric Motor as an Economic Factor in Industrial Life," by Mr. David B. Rushmore, Schenectady, N. Y.

"The Influence of the Electric Motor on Machine Tools," by Mr. A. L. De Leeuw, Elizabethport, N. J.

"Effects of Electrolysis on Engineering Structures," by Prof. Albert F. Ganz, Hoboken, N. J.

"The Mechanical Problem of the Electric Locomotive," by Mr. G. M. Eaton, East Pittsburgh, Pa.

"On the Production of High Permeability in Iron," by Prof. Ernest Wilson, London, England.

"Electric Illumination," by Mr. S. H. Blake, Schenectady, N. Y.

Other papers of interest to the electrical engineering profession are: "Utilities," by Dr. A. C. Humphreys, Hoboken, N. J.; "Public Utilities," by Mr. Edward Willis, Chiswick, England; "Electric Motive Power in the Operation of Railroads," by Mr. W. Hood, San Francisco, Cal.; "Electric Motive Power in the Operation of Railroads," by Mr. E. H. McHenry, New Haven, Conn.; "Power-Plant Design," by Mr. H. S. Putnam, New York; "The Internal-Combustion Engine of the Year 1915," by Prof. C. E. Lucke, New York; "The Development of the Construction of Turbines in the Netherlands," by Mr. D. Dresden, Hengelo, Holland; "The 1915 Steam Turbine," by Mr. E. A. Forsberg, Stockholm, Sweden; "The Diesel Engine in America," by Mr. Max Rotter, St. Louis, Mo.; "Developments in Modern Water-Turbine Practice," by Dr. H. Zoelly, Zurich, Switzerland; "Waterwheels of the Pressure Type," by Mr. A. Pfau, Milwaukee, Wis.; "Hydraulic Power Development and Use," by Mr. J. D. Galloway, San Francisco, Cal.; "Waterwheels of the Impulse Type," by Mr. W. A. Doble, San Francisco, Cal.; "Canadian Hydraulic Power Development," by Mr. C. H. Mitchell, Toronto, Canada; "Motor Vehicles, Passenger Type," by Mr. E. Favary, New York; "Motor Vehicles, Utility Type," by Mr. A. J. Slade, New York; "Motor Tractors," by Mr. F. S. Davis, Chicago, Ill.; "The Boiler of 1915," by Mr. A. D. Pratt, New York; "Electrometallurgy," by Dr. E. F. Roeber, New York; "Electrolytic Refined Copper," by Mr. A. C. Clark, Perth Amboy, N. J.; "Physical Properties of Copper," by Prof. C. R. Hayward, Boston, Mass.; "Gas-Producer Development," by Mr. Z. C. Kline, Central Falls, R. I.; "Some Considerations Regarding Engineering Education in America," by Prof. G. F. Swain, Cambridge, Mass.; "Technical Education for the Professions of Applied Science," by Prof. Ira N. Hollis, Worcester, Mass.

DESTRUCTION WROUGHT BY ERIE FLOOD

How Central Station Was Wrecked and Electric Service Restored in Three Days Amid Great Handicaps

The Erie County Electric Company, which is the largest power-producing company in the northwestern part of Pennsylvania, put a full load back on its wires in the remarkable time of seventy-two hours after its French Street station had been wrecked by the flood which swept through the business section of Erie on the night of Aug. 3. This station of the company, at Twelfth and French Streets, bore the brunt of a dividing 25-mile current, which ran from 5 ft. to 10 ft. deep.

Pouring into French Street from Mill Creek, the flood waters, now out of their course, went two ways, the main stream at the street intersection rising rapidly, and just an hour after the series of cloudbursts south of the city the water began to flow into the station.

All records for rainfall in Erie for nearly a century were broken. Millions of tons of water were washed from the Mill Creek watershed into the narrow channel in three hours, carrying tons of mud and sand, buildings, homes and factories. In this wild, swirling mass thirty-six persons were carried to their death, and the property loss varied from two to three million dollars. Starting above Twenty-sixth Street, between State and French Streets, the waters, now many feet deep and gathering force as they moved upon the city, tore out culverts and tossed houses about like chips. Spreading to State Street and to the east of French Street, the width of three city blocks, the flood ripped out everything in its path. Gathering great piles of wreckage, the water wrenched out and demolished building after building, depositing this débris throughout the flood zone. Everywhere were huge piles of lumber.

Work of restoration was begun immediately by the

HEART OF BUSINESS SECTION OF ERIE SWEPT BY FLOOD

WRECKAGE NEAR ERIE COUNTY ELECTRIC COMPANY'S STATION AND MOTOR-GENERATOR SET ON CAR OUTSIDE OF STATION

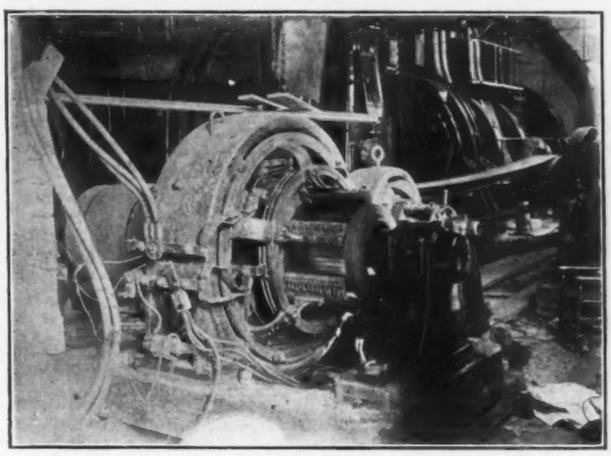
DEBRIS PILED UP IN FRONT OF ERIE COUNTY ELECTRIC COMPANY'S STATION AND LINES DOWN IN REAR OF STATION

city. With the burial of the victims of the flood, clearing of wreckage and health precautions well in hand, the city began an investigation of the cause for Mill Creek overflowing its banks. This is in progress now. State, county and federal authorities are assisting in a plan to prevent a repetition of the flood. It was agreed at a conference of these officials on Aug. 18 that a commission should be selected to solve the problem of floods in the Mill Creek watershed.

When the flood struck the French Street station of the Erie County Electric Company a battery of boilers of about 700 hp. was in operation driving engines directly connected to direct-current generators. In addition there were motor-generator sets, one of 250 kw. and another of 500 kw., in operation. This was about 5.30 o'clock in the evening of Aug. 3, at which time there was a very light load.

Just before this one of the direct-current generators on the balancing set, composed of two 110-volt generators and synchronizing motors, went out, breaking the coupling and smashing the shaft of the synchronous motor. This set was believed to have been struck by lightning.

The water was rising rapidly. At 6.30 o'clock it was



TEMPORARY EQUIPMENT HASTILY INSTALLED

running level with the curb and creeping over the sidewalk, and it soon found its way into the boiler room. Higher and higher it rose until it was 5 ft. deep in the street and nearly up to the stokers in the boiler room.

Every effort was made to switch the current of the water, but with every inch it rose it gained in force, and when the water had reached almost to the armpits of a faithful old stoker, who stood by to keep the plant going, if such a thing were possible, the fires were pulled and all equipment was shut down, excepting a synchronous motor which drives three Brush arc machines stationed on the gallery. By keeping that running sufficient light was furnished to the engine room. This was kept going by using alternating current from station No. 2, at Cranberry and Fifth Streets, where all the alternating-current power is generated (see ELECTRICAL WORLD, July 15, 1911).

By this time, shortly after 9 o'clock, the water was racing madly through the streets. It burst in a front door of the plant on Twelfth Street and poured into the main offices and engine room like a creek. The water had now reached the level of the windows of the main office, 4 ft. from the sidewalk. It swirled through the rooms and trapped two employees in the business office. They ascended desks and escaped by breaking a glass partition and wading shoulder deep to an inner stairway. Their escape was made by using a flashlamp.

The water was now 4 ft. deep on the engine-room floor. In another hour it was 5 ft. deep here and more than 15 ft. in the tunnels and station. This was at the crest of the flood.

Not a wheel in the engine room proper was turning, and employees who had been with the company for years saw it idle for the first time. This was the first time the French Street station had been put out of commission in twenty-seven years.

With the water came tons of sand and mud. The engine-driven generators were completely submerged, and grit lodged in every crevice of the machines. Sand and mud choked every bearing in all the machines as the water swirled about them throughout the night

Realization came quickly to officials of the company. While they knew the plant for the time was ruined, they immediately began preparations for getting it into shape as soon as the waters receded.

Day came, and while the city stood stunned by devastation wrought in so short a time and from such a source, work of restoring lighting and motor service began. The Burke Electric Company rushed a 250-kw. induction motor and two 110-volt direct-current generators and, coupling them up tandem, gave direct current to start the drying-out process on the generators. They also set up two transformers for stepping down from 2200 volts to 240 volts for drying out the motors.

The Burke company also set up a transformer and two synchronous motors in an alley to the west of the plant and connected them directly on the outside lines. With this and with the Erie Lighting Company assisting in taking care of the load, there was sufficient direct current to supply the demand. In this way a big Saturday night load was supplied.

By Monday night the full load was taken care of by the station equipment, two motor-generator sets and one steam-driven direct-current generator, the tandem set and two Burke motor-generator sets outside the building. The inside equipment had been dried out.

The field coils on one of the 500-kw. steam-driven generators were grounded so badly that six coils out of the twelve had to be rewound. This machine was going again by Saturday, Aug. 14, and the drying out of another 550-kw. steam-driven generator was started. The drying out was done by short-circuiting the armatures and separately excited fields.

While discussing station apparatus, it is interesting to note that on Thursday, after the disaster, arrangement was made with Mr. W. G. Ely, superintendent of construction of the General Electric Company, to set up on a flat car at the Schenectady factory a 500-kw. synchronous motor-generator set. This left Schenectady about midnight Thursday on a fast New York Central Chicago freight and, through the efforts of the railroad, was delivered in Erie Saturday morning. By a special arrangement it was transferred to the Pennsylvania lines and in turn to the Buffalo & Lake Erie Traction Company's lines and, by means of a special track, up through French Street to the company's station. This motor-generator set was put in operation Sunday afternoon by making use of the flat car as a portable substation. This was a record performance on the part of the General Electric Company. The alternating-current switchboard on the gallery was not out at any time, and the feeder lines from station No. 2 were intact.

When the great wall of water came sweeping through the creek and overflowing its banks at Eighteenth and French Streets it carried down pole after pole. In French Street, from Twentieth Street to Ninth, the wires were down and tangled beyond separation. This was true throughout the whole district over which the flood spread, from Twenty-sixth Street to the lake, a section 2 miles in length and nearly two blocks wide.

At Twelfth and French Streets, where the feed wires lead from the station, the poles were down and wires knotted and twisted about wreakage which stood 8 ft. to 12 ft. high. It was there that the most serious difficulty to the arc-lighting system was encountered. The alternating-current and direct-current wires were interlocked so tightly that it was impossible to separate them.

A large force of linemen was put to work the day after the flood in an effort to speed the work of restoring service. Miles of wires were cut and poles reset ready for new wires to be strung. This work was pushed with all possible haste, and the third day after the flood all but three circuits were burning. These were switched on the two following nights, and the east side of the city once again had light. The task required the day and night work of hundreds of men, including some of the country's well-known electrical equipment and operating experts.

When news of the flood became known and press dispatches told of the Erie County Electric Company's plant being put out of commission and damaged beyond immediate repair, co-operation came from every side, as noted in the ELECTRICAL WORLD of Aug. 14. This was one of the pleasing features of the work of restoration, and it aided considerably in putting the station back into service in such remarkably quick time.

Controversy Over Service to Federal Building in Pasadena, Cal.

There appears to have been a considerable tempest stirred up in Pasadena through the awarding of a contract by the United States government for supplying electric service to the new Federal Building. Proposals were invited from the municipal lighting plant and the Southern California Edison Company, and the contract was awarded to the private corporation, which was the lowest bidder.

The manager of the Pasadena municipal lighting plant thereupon addressed a communication to the Board of Commissioners of the city of Pasadena protesting against the action of the Southern California Edison Company in underbidding the municipal plant for the business in question. His objections were mainly that the Edison company had violated a city ordinance which fixes certain rates for service, and had also violated an act of the Legislature known as the "unjust competition" act. The matter was referred to the city attorney by the Board of Commissioners, and he gave an opinion to the effect that the Edison company did not violate any city ordinance or act of the State Legislature by making a proposal to supply service, and that no proceedings could be taken against the company until after it should have commenced to deliver service and to charge for it. He further stated that any violation of a city ordinance would jeopardize the Edison company's franchise. The communication from the United States government inviting proposals for electric service, however, contained the following paragraph: "Attention is called to the fact that the sites of federal buildings are extraterritorial, the States having ceded jurisdiction over same, by virtue of which they are exempted from all State, county and municipal ordinances, etc."

It is the belief that the Southern California Edison Company will supply the electric requirements of the Federal Building as soon as it is completed, which will probably be about Oct. 1. In the meantime the control of rates for service to be charged by public utilities in the city of Pasadena has passed from city regulation to State regulation, and in consequence the Edison company cannot break any city ordinance regulating rates. In reference to the giving of special rates to the United States government the Railroad Commission of California has already given a decision in case No. 293. Under the caption of "Free and Reduced Rates," the State commission has expressed its decision in effect as follows:

"The public utilities of this State, other than common carriers, may, if they so desire, in addition to the classes of cases specified as applicable to them in Section 17 of the public utilities act (referring to telephone and telegraph companies), grant free or reduced rate service to (1) the federal and State governments and the political subdivisions thereof, including the departments thereof; (2) public institutions, fairs and other public expositions and celebrations; (3) charity, as defined in this commission's decision No. 421, rendered on Jan. 24, 1913, and (4) employees."

Price Reduction of Electric Pleasure Vehicles

On Aug. 15 the Anderson Electric Car Company, manufacturer of "Detroit electrics," reduced the prices of cars from $600 to $725 each. The company plans to double its output in 1916, and as a result expects to make many economies in all overhead expenses, purchasing, advertising, sales cost and engineering. The savings thus effected, it is thought, will be large enough to warrant the present slash in prices. The company states that the 1916 model is of the same quality as the 1915 car with a few 1916 refinements, no attempt having been made to cheapen the car because of the reduction in price. The highest-priced "Detroit electric" under the new schedule is the five-passenger duplex-drive brougham selling for $2,275, this car being priced before the cut at $3,000. The lowest-priced car is the four-passenger brougham at $1,975, it having been reduced from $2,600.

The Waverley Company has also made large cuts in the prices of its pleasure cars. Reductions of from $500 to $1,000 have already been announced on the selling prices of the latest and highest grade models. Owing to the great demand for machine tools of all kinds brought about by the European war, the Waverley Company has been enabled rapidly to introduce quantity-production methods which it had devised several months before the outbreak of the war. The changes which are now being made at the factory will result in further lowering prices for the company's vehicles.

Prices have not been lowered on either the Rauch & Lang "electrics" or the Baker "electrics." At the New York offices of the Baker, Rauch & Lang Company it was stated that the company did not feel able to reduce the price of the cars and still maintain the quality of its product. The output of the company is in the neighborhood of about 1000 cars a year, and it was stated that unless the output could be increased to the neighborhood of 10,000 cars a year the decreased cost per car due to the manufacture of a larger number of cars would not be sufficient to warrant any appreciable price reduction. Even were the output increased to 10,000 cars, it is not thought that the reduction would amount to more than a couple of hundred dollars.

When asked as to the effect of the war on the sale of pleasure "electrics," the representative in charge stated that the sales had fallen off to a certain extent owing to this cause, but that in the fall the company expected materially to increase its sales, and it was looking forward to decidedly better conditions. It was pointed out that the purchasers of both the Baker "electric" and the Rauch & Lang "electric" were people of conservative character, quick to retrench.

Miscellaneous News Notes

Electrical Pumping in Water-Works.—Out of a total of 4872 towns in the United States listed by the McGraw Waterworks Directory, 969, or approximately 20 per cent, use electricity for pumping. This number includes 493 combined light plants and water-works. Three hundred and thirteen plants are listed in Canada and Newfoundland, of which seventy-five, or 24 per cent, use electrical pumping.

Do Mosquitoes Avoid Red Porch Lamps?—A suburban resident of New York City finds that red-glass or red-dipped incandescent lamps do not attract mosquitoes in the way that the ordinary source of light does. Accordingly, he has installed low-candle-power red lamps on his porches, where only a general illumination is necessary, and so finds it possible, he declares, to sit in comfort just as if no lamp whatever were burning to attract the insect pests.

Electric Cooking on New Mississippi River Steel Barges.—The new steel barges which will make up the Mississippi River fleet now being constructed in connection with the dock improvements at New Orleans will be equipped with individual power lamps driven by internal-combustion engines. Electricity thus produced will be used to operate motor-driven cranes for loading and discharging cargo, to energize the wireless-telegraph equipment, and for cooking and heating in the crews' cabins. Absolute safety from fire will thus be assured for cotton and other inflammable cargoes.

Pennsylvania's Light and Power Utilities' Financial Needs.—During the first half of the calendar year there were filed by electric light and power utilities with the Pennsylvania Public Service Commission applications for authority to issue $566,500 of common stock, $2,500,000 of preferred stock, $3,623,800 of bonds and $3,292,000 of notes, a total of $9,982,300. Most of these applications were filed in the first quarter. No applications to issue capital stock were filed in the second quarter. In all there were thirty-five applications filed by light and power utilities during the six months for permission to issue securities.

Street Lighting Restored at Company's Expense.—After several months of darkness, the street lamps of Olympia, Wash., were put into service on Aug. 8 at the expense of the Olympia Light & Power Company, which supplies the energy. The City Council, after ordering the street lamps discontinued last March, decided at a recent meeting to have the service restored beginning Sept. 1, and the company then arranged to relieve the unsatisfactory conditions obtaining in the interval by presenting the city with street-lighting service for the twenty-three days preceding the date at which payment for the lighting will begin.

A Zeppelin Alarm.—A device to give warning of the expected approach of zeppelins and other hostile air craft has been invented by Mr. Charles Gates, 16 West End Street, Norwich, England, and depends for its operation on the extinguishing of the electricity supply by the local "undertaking" (as central stations are called in England) on the approach of the airships. Interruption of the service causes a bell on the zeppelin alarm to begin ringing and also lights a small battery lamp. The awakened householder can then cut off the bell by means of a switch, while the battery lamp is used to provide a dim illumination.

Purdue Alumni Hold Transcontinental Reunion by Telephone.—Following simultaneous reunions of Purdue University alumni in New York, Chicago, Omaha and San Francisco, on the night of Aug. 20, Dr. W. E. Stone, the president of the university, then in San Francisco, addressed the gatherings in the other cities over the transcontinental telephone line. In each assembly room from San Francisco to New York multiple telephones had been arranged at the banqueters' tables, and through the medium of these and the transcontinental line the speeches and toasts were repeated to all present at the various meetings, 3000 miles apart.

Cattle-Hair Felt Rings on Guy Wires.—In the cattle-grazing country around Wasco, Cal., curious rings of coarse felt-like material appear on the guy wires supporting the poles of the San Joaquin Light & Power Company. For a time the origin of these rings baffled explanation. They are now, however, known to be formed of the hairs of cattle which delight to scratch their sides and backs against the rough points of the twisted ties. As the result of constant rubbing, hairs from the animals' hides are loosened and caused to curl around the wires until a dozen or more soft felt pads are formed, each completely encircling the wires like a succession of soft washers. Incidentally, the points of the clamped guys are worn down until they become perfectly smooth as the result of the continuous rubbing of the cattle.

Motor-Car Lighting Plant for Taking "Movies" by Night.—For taking motion pictures at night amid country scenes far removed from sources of electricity supply a motion-picture producer has assembled a fair-sized power plant on a big motor truck and will use this equipment for the first time in the production of the new Lubin photo-play, "The Great Divide." A. 2000-ft. cable connects the generating plant with the projection lamps, which can thus be taken, into ravines and other inaccessible places where the desired degree of ruggedness of scenery can be secured. The automobile engine is used to drive the lighting generator. A 13-in. navy-type projector searchlamp is also mounted at the side of the driver's seat and can itself be employed to light motion-picture "set-ups" in connection with the other lamps. The entire portable-plant outfit weighs 4 tons.

Motor-Driven Conveyor Belts in New Grand Central Post Office Terminal.—Motor-driven conveyor belts have been employed on a large scale in the mail-handling equipment of the new Grand Central Terminal post office in New York City, from which some 400 tons of mail are delivered each day to 227 trains leaving the Grand Central Station. The loading platform accommodates thirty-three mail cars, eight of which can be loaded simultaneously. The elaborate system of conveyors, bucket lifts, spiral chutes and bag conveyors is expected to eliminate almost entirely carrying mail on hand trucks. The belts carrying bags are operated from the platform by levers and controls. The mail building is connected with the mailing platform by a system of signals and telephones, so that the whole plant can be directed from one central point on the mailing platform where the trains are loaded. The new post office building spans the tracks at Forty-sixth Street and measures 200 ft. by 275 ft.

Garaging Electric Cars on the "European Plan."—The "pay-for-what-you-get plan" has been adopted by a number of electric vehicle garages with success. By this system the owner of the "electric" pays for each class of service separately. For example, there is a specified charge of about $80 for delivering or fetching the car from forty to sixty times a month. From this a deduction of 20 cents is made for each time under forty, with a corresponding excess charge of 25 cents for each time over sixty. The price for the amount of electric energy used per month is specified also, depending on the local rate. General care of car per month is usually rated at about $20, which includes washing, polishing, cleaning of upholstery, and other incidental attentions. There is also an extra charge for dead storage when the car is laid up for ten or more consecutive days. A driver can be employed if the owner desires at the rate of 50 cents per hour, the owner assuming all responsibility.

Canadian Engineers Invite Congress Visitors to Return by Way of Canadian Rockies.—In connection with the International Engineering Congress to be held at San Francisco, Sept. 20 to 25, a committee representing the Canadian Society of Civil Engineers and the Canadian members of the British Institution of Civil Engineers has extended to all members of the leading engineering societies of the United States who will be in attendance at the Congress a cordial invitation to arange their return trips through Canada in order to visit the great cities and mountains of the Canadian Northwest. Special facilities for rail and steamer travel from San Francisco to Victoria and Vancouver have been arranged, and persons desiring to do so may make this diversion from their itinerary at an extra cost of $17.50. A special engineers' train will leave San Francisco Sept. 25 for a personally conducted trip to points of scenic and engineering interest in British Columbia and Alberta, including Lake Louise among the Canadian Rockies. Mr. C. W. Allen, Canadian Pavilion, Panama-Pacific Exposition, San Francisco, is in charge of arrangements.

Associations and Societies

Empire State Gas & Electric Association.—The annual meeting of the Empire State Gas & Electric Association will be held in the Engineering Societies Building, New York City, Oct. 7 and 8. The program for the meeting has not yet been announced. Mr. C. H. B. Chapin is secretary of the association.

Meeting of Radio Engineers.—A meeting of the Institute of Radio Engineers will be held on the evening of Sept. 1 in Room 306, Fayerweather Hall, Columbia University, New York City. Prof. J. Zelleck will present a paper on "The Operating Theory of Frequency Changers," and the society extends a cordial welcome to anyone interested in the subject.

Southern Illinois Central Stations Organized.—Fourteen central stations in southern Illinois were represented at a meeting held at Centralia, Ill., Aug. 12, to effect an organization of central-station men in the southern part of the State. The new association is intended to become an auxiliary of the Illinois State Electrical Association, since the central-station men in "Egypt," as the southern part of Illinois is sometimes called, expressed the feeling that more successful results would follow from a smaller geographical organization. Among the utilities represented were those at Albion, Centralia, Effingham, Farina, Chester, Coulterville, Christopher, Mount Carmel, Mount Vernon, Nashville, Murphysboro, Alto Pass, Collinsville and Sparta. Mr. K. A. Steinhauser of Nashville, Ill., was elected president, Mr. F. J. Higgins of Centralia was elected vice-president, and Mr. Gale Gough of Sparta was made treasurer. The first day's session was spent largely in arranging details of organization, and some time was given over to a discussion of points of interest to operators of small central stations. The next meeting will be held in October and subsequent sessions will be held twice a year thereafter.

Convention of Association of Iron and Steel Electrical Engineers.—The ninth annual convention of the Association of Iron and Steel Electrical Engineers will be held at the Hotel Statler, Detroit, Mich., Sept. 8-11. On Sept. 9 the association will hold a joint session with the American Institute of Electrical Engineers. The program of papers beginning with the afternoon session of Sept. 8 is as follows: "Improving Non-Condensing Power Plant by Use of Direct-Current, Mixed-Pressure Turbine Equipment, etc.," by Mr. R. F. Patterson; "Wire Rope and Its Relation to Steel Making," by Mr. J. F. Howe; "Recent Developments in Power-Generating Apparatus," by Mr. P. M. Lincoln; "Protection and Control of Industrial Electrical Power," by Dr. C. P. Steinmetz; "Motor Generators Versus Rotary Converters," by Mr. E. Freidlaender; "Some of the Latest Developments in Electrical Equipment," by Mr. K. A. Pauly; "Progress in the Iron and Steel Industry and the Electric Furnace," by Dr. K. G. Frank; "Mechanical Analogies in Electricity and Magnetism," by Prof. W. S. Franklin; "The Electrification of Steel Mills and the Use of Central-Station Power," by Messrs. B. Wiley and W. Sykes; "Purchased Power for Steel Mills," by Mr. C. S. Lankton; "Some Electrical Applications in Steel-Mill Practice," by Mr. D. M. Petty; "Latest Development of Electric Cranes for Steel Mills," by Mr. E. H. Kendall; "Installation of Electrical Equipment to Comply with Requirements of Safety," by Mr. W. Greenwood. The session of the morning of Sept. 11 will be given over to open discussion of general subjects.

Panama-Pacific Convention, A. I. E. E., Program.—The Panama-Pacific convention of the American Institute of Electrical Engineers will be held in the Native Sons of the Golden West Building, San Francisco, Sept. 16 and 17. There will be two parallel sessions each morning and three parallel sessions each afternoon. A joint session with the Institute of Radio Engineers is scheduled for the afternoon of Sept. 16 and Sept. 17, and a joint session with the American Electrochemical Society has also been arranged for the afternoon of Sept. 17. The program of papers is as follows: "Physical Limitations in Direct-Current Commutating Machinery," by Mr. B. G. Lamme; "Automatically Controlled Substations," by Messrs. E. W. Allen and Edward Taylor. Marine and Lighting Session.—"Standard Marine Electrical Installations," by Mr. H. A. Hornor; "Recent Improvements in Electric Lighting of Steam-Railroad Cars," by Mr. R. C. Lanphier. Electrophysics Session.—"The Effects of Transient Voltages on Dielectrics," by Mr. F. W. Peek, Jr.; "Arc Phenomena," by Mr. A. G. Collis; "Experimental Researches on Skin Effect in Conductors," by Dr. A. E. Kennelly, Prof. F. A. Laws and Mr. T. H. Pierce. Valuation of Public Utilities Session.—Symposium on inventories and appraisals of properties; Part I, by Mr. C. L. Cory; Part II, by Mr. W. G. Vincent; Part III, by Mr. W. J. Norton. These papers will be supplemented at the session by contributions from other members of the committee on inventories and appraisals of properties. Joint Session with the Institute of Radio Engineers.—"Sustained High Frequency, High-Voltage Discharges," by Prof. Harris J. Ryan and Mr. Roland G. Marx. Telephony and Telegraphy Session.—"Submarine Cable Rapid Telegraphy: Ocean and Intercontinental Telephony," by Mr. Bela Gati; "Automatic Switchboard Telephone System of Los Angeles, Cal.," by Mr. W. Lee Campbell; continuation of discussion on inductive interference, introduced by joint committee on inductive interference. Mine Work Session.—"Diesel Engines for Generator Drive," by Mr. Charles Legrand; "A Large Electric Hoist," by Mr. Wilfred Sykes; "The Modern Electric Mine Locomotive," by Mr. Graham Bright. Joint session with the American Electrochemical Society.—"Overhead Electrolysis and Porcelain Strain Insulators," by Mr. S. L. Foster; "Corrosion of Copper Wireless Antennas," by Mr. L. W. Webb; "Electrochemical Possibilities in California and on the Pacific Coast," by Mr. J. W. Beckman. Transmission Session.—"Delta Cross-Connection of Transformers," by Mr. G. P. Roux; "Harmonics in Transformer Magnetizing Currents," by Mr. J. F. Peters; "Phenomena Accompanying Transmission with Some Types of Star Transformer Connections," by Mr. L. N. Robinson; "Abnormal Voltages in Transformers," by Mr. J. Murray Weed; "Calculation of Short-Circuit Phenomena of Alternators," by Mr. N. S. Diamant. Joint Session with the Institute of Radio Engineers.—"Radio Development in the United States," by Mr. Robert H. Marriott.

Public Service Commission News

California Commission

The Railroad Commission of California rendered a decision on Aug. 16 revising the whole system of advance deposits required by gas, water, electric and telephone companies in that State and holding that it was the duty of these utilities to make all reasonable extensions for the service of their patrons. The decision, which will become effective on Oct. 11, abolishes to a large degree the present system of deposits and entails the refunding of substantial sums now held by the various utilities throughout the State as deposit from patrons. The commission received 634 separate complaints on the subject of these deposits and the refusal of the utilities to make extensions. The investigation consumed ten months and entailed an inquiry into each of the complaints and an examination into the rules and practices of about 1000 corporations. The decision takes the form of eighteen separate rules, which cover most of the 634 cases under consideration. Under the new ruling, customers taking flat-rate service from water, gas, electric or telephone utilities henceforth need pay no deposits if they own the property served or can secure a responsible guarantor or have paid their bills promptly during the preceding year. The five-dollar deposit charge is reduced to a maximum of $2.50 for residence or domestic consumers. Public utility companies can no longer discontinue service for failure to pay a back bill, but may protect themselves by demanding deposits as payment in advance if back bills are not paid. Service henceforth cannot be discontinued until after reasonable notice of intention so to do. Deposits will bear interest and must be returned after twelve months. Except in cases of extensions, the signing of contracts as a condition precedent to service is abolished. The so-called service connection charges of water, electric, gas and telephone utilities are abolished. Prima facie, it is made the duty of utilities operating under general franchises in cities to build extensions at their own cost, but in unusual cases they may

apply to the railroad commission for a ruling. The question of who shall bear the cost of extensions in unincorporated territory shall be settled between the parties or, if they cannot agree, by the railroad commission. Within ninety days utilities shall return the deposits hitherto made to all persons who have paid their bills promptly during the last year. Application may be made to the commission for relief if hardship results from the application of any rule to a particular case.

District of Columbia Commission

In its annual report for 1914 the commission says that it has not established rates for service for the reason that rates will depend on the value of the property and the valuations have not yet been completed. However, action has been taken to require the discontinuance of all rates which were found to be discriminatory.

The committee investigated the accounts of the Washington Railway & Electric Company. The principal points developed by the investigation were stated to be the following:

"(1) The directors and officers of this company and of its subsidiary railway companies and of the Potomac Electric Power Company are in large part the same.

"(2) There was in existence a contract between the Washington Railway & Electric Company and the Potomac Electric Power Company fixing the price at which the former company should purchase energy from the latter company. This contract, though never abrogated, was being ignored. Search was made for some basis on which rates were paid, but without success.

"(3) Energy was being sold by the Washington Railway & Electric Company to its subsidiary railway companies at different rates and based on different units of measurement.

"(4) The Washington Railway & Electric Company was apparently not attempting to provide for depreciation as provided by the public-utilities law.

"(5) Transfers of property were being made between the Washington Railway & Electrical Company and the Potomac Electric Power Company at arbitrary values.

"The conclusion reached by the commission was that the close relationship between the Washington Railway & Electric Company and the Potomac Electric Power Company is not for the benefit of the public. The commission, therefore, submitted to Congress a draft of a bill which would result in the complete separation of these two companies, with recommendation for its passage. This bill was introduced in the House of Representatives, was referred by that body to the committee on the District of Columbia, but was not reported back to the house by that committee."

A case arising from the effort of the commission to effect a separation of the properties is now pending in the courts.

The commission recommended to Congress a special appropriation of $110,000 for valuations. Congress having appropriated $100,000, the work of valuing the larger utilities was commenced. As the work progressed it became evident that the original estimate of funds and time was too low. This was due to the use of the cost of similar valuations elsewhere as a basis for estimate without making sufficient allowance for the fact that the proportion of the construction in the District of Columbia which is underground far exceeds that in other cities, and also to the fact that it was found to be necessary for the commission to inventory the properties, and to the attitude assumed by some of the utilities. Recommendation has therefore been made to Congress for an additional appropriation of $40,000 to complete the work.

The engineering section of the valuation bureau consisted on Dec. 31, 1914, of nine departments, each with a department engineer in charge, all under the direction of the chief engineer.

Idaho Commission.

The commission has issued an order denying for rehearing in some of its phases the case of the Washington Water Power Company of Spokane, Wash., against the Montana Power Company, the Thompson Falls Power Company, the Federal Mining & Smelting Company, and the Tamarack & Custer Consolidated Mining Company. The case has already been heard by the commission, and orders have been entered putting into effect certain motor-service rates temporarily. It was on these orders that the petitions for rehearing were filed. The purpose of the commission is to combine all the issues awaiting determination if there is to be a rehearing of the case.

Oregon Commission

The decision of the commission in regard to the electric lighting, heating and motor-service rates of the Eastern Oregon Light & Power Company has been issued. In determining the proportion of the total plant of the utilities to be assigned for water-power rights and privileges the commission determined the value of each power now operated as a whole to the extent to which it has been developed, regardless of whether it is entirely on patented land or in part grounded on revocable permit from the government to use portions of the national forest. The commission then apportioned the value of the powers which are dependent in part upon the government permits and included the proportion which ownership by the utility indicates as fairly representing the value of the privately owned lands and of appurtenant rights and privileges. The commission will not capitalize "the bounty of the nation for the benefit of the individual." The expenses incident to the use of the government land and payments on account of the use permits are treated as operating expenses. Inability to procure the books of account of the predecessor corporations included in the consolidation made it impossible to state the precise original cash cost of the various portions of the physical properties. The apparent cost of the constituent companies and property was $1,552,473. The total electric revenues were found to be $211,138, indicating an average revenue per kilowatt-hour sold of 8.07 cents. To reproduce the properties used and useful in the public service as of June 30, 1914, considered as a going concern, would reasonably have required the expenditure of the following sums: Electric-utility properties, $1,186,712; gas-utility properties, $42,-738; total operating properties, $1,229,450. Material and supplies on hand are included in these sums, but not working capital or credit.

Depreciation has lessened the value of the present operating plant by the following sums as compared with new plant of the character contemplated in the reproduction-cost new estimates: Electric-utility properties, $166,440; gas-utility properties, $15,550. The commission therefore finds the values to be as follows: Electric-utility properties, $1,020,300; gas-utility properties, $27,200; total, $1,047,500.

In addition, the company will necessarily employ as working capital either cash or credit to the amount of $20,000 in its electric-utility operations and of $1,000 in its gas-utility operations. The rates involved, except at Baker, are considerably above the general level of rates charged by the other utilities in Oregon. The maximum rate established is 10 cents per kilowatt-hour, subject to a discount of 10 per cent. The company is directed to set up as part of its accounts the depreciation reserve found to be reasonable and necessary. Before Sept. 1, 1915, it is required to submit to the commission any plan it may desire to have considered for the handling of such depreciation reserves.

The attention of the commission has been called to a stenographic error in the case of the city of Bend, Ore., against the Bend Water, Light & Power Company, reported in these columns Aug. 7. The error involved $10,000 in the cost of reproducing the plant new and in the reproduction cost less depreciation. The cost of reproducing the plant new on Dec. 31, 1914, would have required an expenditure of approximately $104,282, instead of $94,282, and the reproduction cost lessened by depreciation was as of Dec. 31, 1914, $94,118, instead of $34,118. The changes have been ordered by the commission.

Indiana Commission

An increase in telephone rates at Logansport, Ind., has been granted by the Public Service Commission of Indiana. The Home Telephone Company was the petitioner. The commission in its order found that the revenues of the company were inadequate to provide a proper depreciation fund. The increase in rates to single residences was from $15 a year to $24 a year.

Personal

Mr. M. R. Phipps has been appointed general manager of the Brush Electric Company of Galveston, Tex., succeeding Mr. Fred M. Lege, Jr., who resigned.

Mr. G. W. Milliken, superintendent of the Arkansas Valley Railway, Light & Power Company at La Junta, Col., has been re-elected secretary of the La Junta Merchants' Association.

Mr. H. A. Palmer has been appointed general superintendent of the electric light and power department for the Virginia Railway & Power Company of Richmond, Va., to succeed Mr. J. H. Strickland.

Mr. A. H. Krom, formerly an electrical engineer in the Chicago department of gas and electricity, has been appointed telephone engineer on the staff of the State Public Utilities Commission of Illinois.

Mr. Joseph E. Mercure, formerly of Springfield, Mass., has been appointed superintendent of a large power plant at Bombay, India. Mr. Mercure planned to visit the Exposition at San Francisco last week and to sail for Bombay on Aug. 21.

Mr. F. J. Derge, who has been superintendent of the lighting and power department of the Toledo (Ohio) Railways & Light Company, has been appointed to succeed Mr. Milan R. Bump as chief engineer of the Doherty operating organization at the time of Mr. Bump's resignation, which takes effect Oct. 1.

Mr. R. E. Berger has been appointed superintendent of the power and lighting department of the Toledo Railways & Light Company, Toledo, Ohio, succeeding Mr. F. J. Derge. Mr. Berger until recently has been general manager of the Elyria (Ohio) properties of the Doherty company, which also controls the Toledo property.

Mr. Fred M. Lege, Jr., has resigned as general manager of the Brush Electric Company of Galveston, Tex. For several years past Mr. Lege has also acted as manager of the Galveston Gas Company, and he will continue in this position with the local gas company, which was recently purchased by Electric Bond & Share interests.

Sir Adam Beck, chairman of the Hydroelectric Power Commission of Ontario, was presented with an electric automobile on the occasion of the recent opening of the London & Port Stanley Railway at London, Ont. The presentation speech was made by Mr. Philip Pocock of London, Ont., who is the chairman of the London & Port Stanley Railway.

Mr. J. B. Johnson has been appointed general manager of the Elyria (Ohio) electric-lighting property of H. L. Doherty & Company, New York, succeeding Mr. R. E. Berger, who has been appointed superintendent of the power and lighting department of the Toledo Railways & Light Company. Mr. Johnson was formerly superintendent at Elyria.

Mr. J. Howard Bothwell, formerly manager of the Bothwell-Guthman Electric Company, contractor and electrical engineer, Youngstown, Ohio, is now president and general manager of the Bothwell Electric Company, 15 Spring Street, Youngstown. Mr. Bothwell, who is a prominent Jovian, was recently elected president of the Ohio Electrical Contractors' Association.

Dr. Wilhelm von Siemens, the son of the founder of the great Siemens works in Germany and the present head of the firm, celebrated his sixtieth birthday on July 30. In appreciative comments appearing in the current German technical periodicals mention is made of the fact that the Siemens concerns now employ 80,000 persons, and that some 21,000 employees of the companies are at present in active service in the German army.

Mr. Milan R. Bump has tendered his resignation as chief engineer of the Doherty operating organization, to take effect Oct. 1, when he will become vice-president of the Picher Lead Company, one of the principal zinc-producing organizations in the Joplin (Mo.) district. Mr. Bump was formerly treasurer and general manager of the Empire District Electric Company of Joplin, which supplies energy to operate a large number of mines in the neighboring zinc fields.

Prof. William Suddards Franklin, who, as announced in these columns last week, has resigned as professor of physics at Lehigh University, South Bethlehem, Pa., has arranged to spend the coming fall and winter in making an extended tour of American universities and technical schools to present a series of experimental lectures. Most of these lectures have been delivered by Professor Franklin during the last two or three years before the New Haven (Conn.), Pittsfield (Mass.) and Philadelphia (Pa.) branches of the A. I. E. E., where they were received with enthusiastic interest. Professor Franklin was graduated from Kansas University and afterward taught there as professor of physics, leaving in 1892 to become professor of physics and electrical engineering at Iowa State College. In 1897 Professor Franklin came to Lehigh and was in 1903 appointed to the chair of physics and electrical engineering. In 1901 he received the degree of Sc.D. from Cornell. Professor Franklin is the author of a number of books on electrical engineering, physics and mathematics. Written in broader vein, his collection of essays entitled "Bill's School and Mine" has attracted wide attention and appreciation. He is also a joint author of "Franklin, MacNutt and Charles' Calculus," and of "Elements of Physics," "Elements of Alternating Currents," "Elements of Electrical Engineering," "Light and Sound," "Practical Physics," "Electric Waves," etc.

W. S. FRANKLIN

Mr. Bassett Jones, consulting engineer, New York City, whose valuable article on "Mobile Color and Stage Lighting," which has been appearing in the last four issues of the Electrical World, is brought to a close in this number, has had a varied career in the engineering and design branches of the electrical industry and illuminating science. Born on Staten Island, N. Y., in 1877, he received his preliminary education in New York City and afterward attended the Massachusetts Institute of Technology. In 1901 and 1902 he served successively with the Sprague Electric Company, the New York Edison Company, the New York Telephone Company and the Electric Storage Battery Company, and in the last-named year was manager of the New York office of W. N. Tobin, an engineering contractor. In 1904 he was made manager of the Pittsburgh office of Clark & MacMullen, consulting engineers, and from 1904 to 1906 he acted as consulting engineer for Douglas Robinson, Charles S. Brown & Company, having personal charge of thirty-two isolated plants and of equipment in 500 buildings in New York City. Since 1907 Mr. Jones has been associated with Mr. Henry C. Meyer, Jr., New York City, as consulting electrical engineer. Among the important electrical installations designed by Mr. Jones in this connection are those of the Chelsea Piers at New York, the United States Military Academy at West Point, the Prudential Insurance Company buildings at Newark, N. J.; the Equitable Building, New York; J. P. Morgan & Company's building, New York; the Hotel Statler, Detroit, Mich.; the Soldiers' Memorial Building, Pittsburgh, Pa., and the Lord & Taylor store, New York. Especially interesting has been Mr. Jones' work in designing and constructing the special stage-lighting equipment for "Peter Pan" as recently played by Miss Maude Adams. As stage manager for the Society of Ecole des

BASSETT JONES

Beaux Arts Architects, Mr. Jones produced the lighting effects for the latter's "Venetian Spectacle and Pageant" in 1913, "The Judgment of Paris," 1914, and "The Dispute of the Muses," 1915. Mr. Jones is a member of the A. I. E. E., the I. E. S., and the Illuminating Engineers' Society of London, England, and a fellow of the Royal Society of Architects, London.

Obituary

Max Hebgen, vice-president and general manager of the Montana Power Company, with headquarters at Butte, Mont., died at the Presbyterian Hospital, Chicago, Aug. 24, after a long illness.

Arthur H. Crawley, president of the Crawley Electric Company of Peoria, Ill., and part owner of the Illinois Electric Manufacturing Company, died at his home at Peoria, Aug. 10, at the age of fifty years. Mr. Crawley's death came as the result of a chronic illness of long duration.

Edward Hammond Hoyt, who died at Haverhill, Mass., Aug. 7, at the age of sixty-six, was associated in the pioneer days with the Thomson-Houston Electric Company, one of the forerunners of the present General Electric Company. In 1892 Mr. Hoyt was appointed electrical engineer of the Haverhill-Groveland electric street railway. Next he became chief engineer for the Merrimac Valley and the Lowell, Lawrence and Haverhill electric railways, and later he spent several years in the South in electrical construction work. At the time the Spanish-American war broke out Mr. Hoyt resigned his seat in the Massachusetts Legislature to accept a commission in the United States Army Engineer Corps.

Robert Hammond, a pioneer electrical engineer of England and for thirteen years the treasurer of the British Institution of Electrical Engineers, died Aug. 5, at the age of sixty-five. Mr. Hammond's first electrical installation was made in 1880, when he equipped blast furnaces near Middlesborough with Brush arc lamps. In 1881 he erected Great Britain's first central station for electricity supply to the public, using a Brush dynamo which delivered 10 amp. at 2000 volts. A man of large grasp and powers of persuasion, Mr. Hammond was also active before Parliament in securing measures for the improvement of London's electricity supply. During the earlier years of electric lighting he visited the United States many times to inspect lighting plants here. Mr. Hammond was also an energetic educational worker, and in 1882 he established the Hammond Electrical Engineering College, an institution afterward taken over by Faraday House, in the management of which he was also prominent from the first.

John R. Graham, president of the Bangor (Me.) Railway & Electric Company and one of the best known public utility operators in New England, died at Intervale, N. H., on Aug. 24, at the age of sixty-eight. Mr. Graham was born in the north of Ireland and his parents came to Boston, Mass., in 1852. He served in the last year of the Civil War in infantry and cavalry regiments from Massachusetts, and after engaging in shoe manufacturing at Quincy, Mass., entered the electric-railway field in the reorganization of the Quincy street railway, which was later merged with the Old Colony system, now a part of the Bay State organization. While at Quincy he became a director of the Quincy Electric Light & Power Company and of the Weymouth central station. In 1902 he went to Bangor to rehabilitate the local central-station and railway properties, and in the subsequent period, associated with the banking houses of J. & W. Seligman, New York, and E. W. Clark & Company, Philadelphia, became the dominant figure in 75 per cent of the public utilities of Maine. His activities included the construction of hydroelectric plants at Ellsworth, on the Union River, at Bonny Eagle and West Buxton, on the Saco, with transmission lines; the consolidation and centralization of properties at Portland, Me., and subsequent development of the Cumberland County Power & Light Company of Portland, besides the unification and extension of electric railways between Waterville, Me., and Bath, Me., with collateral power and lighting interests. Mr. Graham had served in the Massachusetts Legislature and was a director of trust companies at Bangor and Ellsworth, besides being president of the Bar Harbor & Union River Power Company.

Corporate and Financial

American Light & Traction Company, New York, N. Y.—The statement for the twelve months ended June 30, 1915, follows:

	1915	1914
Earnings on stocks of subsidiary companies owned by this company	$3,980,302	$3,697,743
Miscellaneous earnings	754,962	717,867
Gross earnings	$4,735,264	$4,415,610
Expenses	157,599	139,465
Net earnings	$4,577,665	$4,276,145
Surplus and reserve previous year	9,577,664	8,973,146
Total surplus earnings	$14,155,329	$13,249,291
Less:		
Cash dividends on preferred stock	$854,172	$854,172
Cash dividends on common stock	1,553,333	1,408,728
Stock dividends on common stock	1,553,332	1,408,727
Total dividends	$3,960,837	$3,671,627
Surplus balance	$10,194,492	$9,577,664

American Power & Light Company, New York, N. Y.—The Kansas Gas & Electric Company, a subsidiary, has acquired the Arkansas City (Kan.) Gas & Electric Light Company and the Eldorado (Kan.) Electric & Refrigerating Company. The Arkansas City property was capitalized at $100,000, no bonds outstanding, and the Eldorado company was capitalized for $50,000, also with no bonds outstanding. The Southwestern Power & Light Company and the Texas Power & Light Company, other subsidiaries, have also acquired within the last few weeks a number of small electric light and power properties in Texas, and these are now being connected with existing transmission and distribution systems. American Power & Light subsidiaries now supply electric light and power service to 114 communities, artificial gas to fifteen communities, natural gas to four communities, water service to seven communities, street-railway service to three communities, and interurban railway service to three communities. The total population served is estimated at 970,000. Gross earnings of all the properties now owned by the subsidiaries, irrespective of the dates of their acquisition, for the twelve months ended July 31, 1915, were in excess of $7,150,000, while net earnings were in excess of $3,375,000.

Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.—The New York Public Service Commission, Second District, has authorized an issue of $500,000 of ten-year 6 per cent bonds, the proceeds from which will be expended in providing extensions and improvements to its properties in Poughkeepsie, Newburgh and surrounding territory. The bonds will be convertible into common stock on and after Oct. 1, 1918. An issue of stock to meet the conversion demand is also authorized.

The Chickasha (Okla.) Gas & Electric Company.—A block of $50,000 of first and refunding mortgage 5 per cent bonds due Jan. 1, 1934, are being offered at 88 and interest.

Consolidated Electric Company, San Francisco, Cal.—The United Light & Power Company (of California), the Equitable Light & Power Company, the Consumers' Light & Power Company, the Southside Light & Power Company, the Central Oakland Light & Power Company, the United Light & Power Company (of New Jersey), the Consolidated Electric Company and the Great Western Power Company have filed with the California Railroad Commission a supplemental application for approval of an agreement with the Anglo-California Trust Company and prospective purchasers of the general mortgage bonds of the Consolidated company to expedite the reorganization of the United company and subsidiary companies. The application says that unexpected delays have occurred in the carrying out of the plan of reorganization due to the fact that the reorganization committee has been unable to secure the deposit for exchange of all the securities of the United company and subsidiary companies outstanding in the hands of the general public, but has caused to be deposited for exchange, according to the plan, more than 90 per cent of the gold notes of the United company of New Jersey and all but forty-six of the bonds of the United company of California. By the agreement the Consolidated company will deposit with the trust company all securities it may receive in exchange for its bonds and will not permit any of the securities, after exchanging bonds therefor, to remain outstanding or in any other hands than those of the trustee.

Continental & Electric Corporation, Cleveland, Ohio.—A block of first-lien sinking-fund 5 per cent gold bonds due Nov. 1, 1927, are being offered at 91¼ and interest, to yield 6 per cent.

General Gas & Electric Company, New York, N. Y.—As the annual report will not be published before the end of the year and as the company has been greatly enlarged recently by the acquisition of the Atlantic Gas & Electric properties, a brief interim report has been sent to security holders. The following figures show the proportions of earnings from, respectively, electric light and power, gas and railways, both for the old General Gas & Electric properties and the company as it is now constituted:

Calendar Year of 1914	General Gas as Operated, Per Cent	With Atlantic Properties Included, Per Cent
Operating revenues:		
Railway department	34.5	15.8
Light and power department	36.0	63.0
Gas department	29.5	21.2

The proportion of street-railway earnings in the total earnings has been reduced from 34.5 per cent to less than 16 per cent. The Atlantic Gas & Electric properties include no street railways. The only connection of these properties with railway interests is through the sale of energy. The proportion of earnings for the original General Gas & Electric Company from gas and electric light and power properties as compared with those from railways is increasing steadily. There are more than 800 General Gas & Electric stockholders. The stock is scattered broadly and is held mostly in small lots for investment. Decided progress has been made in reorganizing and improving the executive and operating forces of newly acquired companies. Similar progress has been made in establishing the various companies in the good-will of communities. Some of the Atlantic companies were involved in lawsuits, but the directors feel assured already that all the important legal matters will be settled satisfactorily within a short time. Several misunderstandings with state public service commissions are being adjusted rapidly, and the companies will have the confidence and good-will of all the commissions with which they are in contact. The various properties are situated in prosperous communities in Pennsylvania, New York, New Jersey, Ohio and Vermont, in some of which particularly good opportunities for securing additional profitable business exist. An increase in income has been produced in spite of the extraordinary expenses necessarily attending a change of management, business conditions and, during the last winter, exceptionally unsatisfactory conditions for water-power properties. A controlling interest in the Atlantic Gas & Electric properties was acquired on April 29, 1915. The combined earnings of controlled companies for the twelve months ended May 31 have been as follows:

	1915	1914
Operating revenues	$2,260,172	$2,132,422
Operating expenses and taxes	1,462,246	1,361,119
Operating income	$797,926	$771,303
Other income	18,337	16,977
Gross income	$816,263	$778,280

Kansas City (Mo.) Railway & Light Company.—A plan for the reorganization of the street railways and lighting properties in Kansas City which was prepared by Judge W. C. Hook of the United States Circuit Court provides for the separation of the properties. A new company called the Kansas City Railway Company is to acquire title to the street-railway properties, and the Kansas City Electric Light Company is to be used to own the electric-light properties. Under the plan the light company is authorized to issue first mortgage bonds, of which there are to be issued at the present time for the purpose of reorganization $3,060,000, and from time to time to issue for special expenditures $1,940,000, to pay for an equal amount of additions, extensions, betterments, etc. The next $10,000,000 thereof shall pay for 85 per cent of the next such improvements, and the remainder for 50 per cent of such further improvements. The bonds shall be dated July 1, 1915, and due July 7, 1944. The initial issue of $3,006,000 is to bear interest at the rate of 5 per cent, while additional bonds will be at the rate of 6 per cent. The company is to be further authorized to issue $1,917,300 of second mortgage 6 per cent bonds dated July 1, 1915, and due July 7, 1944, to be issued at once for the purposes of the plan. This will be a close issue and the mortgage will require the sum of $38,346 per annum to be paid by the company as a sinking fund for the redemption of these bonds. The company is besides authorized to issue such capital stock as the public service commissions of Missouri and Kansas may permit. The present issue of first mortgage bonds will retire 30 per cent of the Kansas City Railway & Light Company first lien 5 per cent bonds, the remaining 70 per cent to be retired by the new railway company. The issue of second mortgage bonds will retire 35 per cent of the Kansas City Railway & Light Company's 6 per cent notes, the remaining 65 per cent to be retired by the new railway company's second mortgage, series A bonds. Engineers of the Public Service Commission of Missouri have made a valuation of the electric-light companies and have determined the depreciated value as of June 30, 1915, to be $5,812,534. This valuation does not include allowances for intangible values, going concern and bond discount. The additional amount to be allowed for these items will hereafter be presented to the commission. Mr. Philip J. Kealy has appraised the electric-light properties and has stated their value to be $9,183,464. Kuhn, Loeb & Company, Lee, Higginson & Company and Blair & Company have consented to act as reorganization managers under this plan. Mr. H. L. Stuart of H. W. Halsey & Company, Chicago, Ill., will be the personal representative of Judge Hook to co-operate with the managers in the carrying out of the plan. To become parties to the plan holders of securities mentioned therein will deposit their holdings on or before Oct. 1, 1915.

Martinsburg (W. Va.) Power Company.—It has been announced that arrangements have been completed for the reorganization of the company under an agreement with Mr. E. L. Coblentz, president of the Hagerstown & Frederick Railway Company. The name of the company will be changed to the Potomac Light & Power Company. The new company will be organized under the laws of West Virginia and will be capitalized at $1,000,000. Under the agreement with the railway company the power company will supply the railway company with energy when water conditions are satisfactory and energy can be cheaply generated. When the power company has unfavorable water conditions that would necessitate the starting up of the steam reserve plant the railway company will supply the necessary energy from its plant. The railway company has therefore at its disposal a cheap energy for most of the year, and the power company will not be compelled during a few months of the year to go to the great expense of operating its steam plant.

Memphis (Tenn.) Consolidated Gas & Electric Company.—At the office of the president of the company it was stated there was no truth in the reports that the company was undergoing a consolidation with the Merchants' Power Company. The report, it is thought, was in connection with the fact that the Merchants' company, unless it makes an acceptable selling offer to the city of Memphis by Jan. 1, 1916, will be taken over at a price agreed upon by arbitration. The city has a fund of $1,000,000 or more with which to establish a municipal plant.

Tulare County Power Company, Lindsay, Cal.—Arrangements have been completed whereby stockholders of the company will receive some of the cash due them as the result of selling the company's properties and rights to the Mount Whitney Power & Electric Company. At the time of the purchase the Mount Whitney company found it impossible to pay the entire amount of cash and therefore gave the unpaid portion, which amounted to $243,000, in short-time notes. Arrangements have since been completed with Blythe, Witter & Company of San Francisco to take over the notes on an 8 per cent basis, and the proceeds therefrom have been applied to the Tulare company's account. Disbursements will be made to the stockholders as soon as possible. At a meeting of the directors of the Tulare company it was decided to make a payment of $35 per share on both preferred and consumers' stock and a further payment of $20 on each share of preferred stock.

Wellsburg (W. Va.) Electric Light, Heat & Power Company.—The stocks of this company and of the Steubenville, Wellsburg & Wierton Railway Company were acquired on July 1, 1915, by the Virginia & Ohio Securities Corporation, but the two companies have not been merged.

Manufacturing and Industrial

The Columbia Lamp Division, National Lamp Works, General Electric Company, announces that its general sales Office, formerly in the Equitable Building, St. Louis, Mo., has been removed to the Title Guarantee Building, 706 Chestnut Street, St. Louis, Mo.

The National Tank & Pipe Company, Portland, Ore., is the new name adopted by the firm previously known as the Pacific Tank & Pipe Company. The new company has been incorporated in the State of Oregon, its personnel remaining the same as that of its predecessor.

The P. & B. Manufacturing Company, Milwaukee, Wis., has removed to larger quarters at 189 Fifth Street and has increased its capital stock from $5,000 to $25,000. This company has appointed Mr. A. Hall Berry, 97 Warren Street, New York City, sole agent for its "Sun Ray" electric-heating pad.

The Ellcon Company, New York, N. Y., has received orders for "E. M. B." unbreakable resistances for use on twelve mining locomotives from both the Goodman Manufacturing Company, Chicago, Ill., and the Copper Range Consolidated Company, Houghton, Mich. An order for twelve sets of resistances for crane duty has also been received from the Maryland Steel Company, Sparrow Point, Md.

The Wood Manufacturing Company, Fairfield, Conn., recently utilized twenty of its "Newtype" spot lamps, each one using argon gas lamps, to light the way for a parade in Fairfield, the lamps being placed upon an automobile. The lamps lock at any angle desired and are attached to the sides of the windshield of an automobile, being equipped with a mirror on the back for use in the daytime, a requirement now being enforced in many cities.

The Gilpin V. C. Company has recently opened offices at 110-112 West Fortieth Street, New York City, as broker in electrical merchandise. It is the intention of this company to secure from various manufacturers lists of obsolete, slow-selling and dead stock, short-ends, over-production, etc., recording these on a general list which will be mailed, together with net cash prices, to numerous customers throughout the country. The first list will be issued about Sept. 10.

Electrical Imports to East Africa.—During 1914 there arrived at the port of Lourenço Marquez, in Portuguese East Africa, for local use, electrical supplies to the value of $20,582, of which $576 worth was furnished by the United States, and in addition, $13,086 worth of telegraph material and $7,057 worth of telephone material, none of which was furnished by the United States. During the same year there also arrived at the same port in transit to the Transvaal electrical supplies to the value of $753,627, of which $31,777 was from the United States.

The Hartford Machine Screw Company, Hartford, Conn., expects the new additions to its plant to be completed and equipped by the first of September. In May several old buildings, including the offices, were torn down to make room for two spacious new buildings. One of these will be a six-story structure, 206 ft. long by 46 ft. wide, and the other will be a large two-story building with a convenient railroad siding to facilitate shipping. The two buildings are designed to have a floor space of about 80,000 sq. ft. Machinery and equipment of the latest type are being installed as rapidly as possible, permitting greatly increased production.

A Telephone Device That Calls the Waiting Subscriber.—A new telephone device placed on the market in London, England, by Messrs. Shannon provides means for summoning a subscriber back to the telephone after he has been asked to "hold the wire" while the party at the other end is looking up some desired information. With this device it is no longer necessary for the waiting subscriber to hold the receiver to his ear. Instead, he places the earpiece on the "Telhorn" and goes about his duties in the room until he hears the calling party's "hello," which the "Telhorn" so amplifies as to make it heard throughout the room.

The Snyder Electric Furnace Company, Chicago, has made arrangements to have one of its commercial-type 1-ton holding-capacity, 10-ton-per-twenty-four-hour-day-capacity electric furnaces in operation at the foundry and machine exhibition, Atlantic City, Sept. 25 to Oct. 1. The furnace will be used for melting cold scrap, and pourings will be made three times each day. The finished castings will be cleaned by auxiliary apparatus in nearby booths and some of each day's output will be machined in the hall. Tests will be made at Philadelphia of castings from each heat, and the results will be announced the following day. Each heat will be taken off under the direction of some prominent foundryman.

Slate Production in 1914.—In a report prepared by Mr. A. T. Coons on the production of slate in 1914 and issued by the United States Geographical Survey it is stated that for the last twelve years the value of the slate output has remained practically stationary. As compared with 1905, when the output was valued at $5,496,207, the value for 1914 ($5,706,787) showed an increase of only $210,580, or 3.8 per cent. The largest output reported was in 1908, when the value ($6,316,817) was $610,030, or 9.6 per cent, greater than in 1914. In 1914 the value of slate produced in the United States was $5,706,787, representing a decrease of 7.59 per cent from $6,175,476 in 1913. Lack of building operations is said to have curtailed the demand for slate in various forms, and as a result the production has been decreased.

American Rotary Valve Company.—Mr. William C. Whitney Beattie, who last spring joined the staff of the American Rotary Valve Company, Anderson, Ind., manufacturer of Jenney motors and generators and stationary vacuum-cleaning machines, is now with the New York office of the company, 30 Church Street, New York City. For several years Mr. Beattie was in charge of the printing-machinery and equipment division of the New York office of the Sprague Electric Works of the General Electric Company, and he is well known among printers and in the printers' supply trade in the East. In 1914 he acted as secretary and treasurer of the Rockland County Sales Company, Inc., dealer in automobiles, and was several months ago appointed manager of the Philadelphia office of the American Rotary Valve Company.

The Luitwieler Pumping Engine Company, Rochester, N. Y., the holding company for the Luitwieler patents, announces that it has perfected its lines of pumping engines and motor-operated fire apparatus and is now beginning to organize two large companies with $1,00,000 capital to build its products under license. One company will have headquarters in Rochester, N. Y., and the other in Los Angeles, Cal. All the assets of the old company at Rochester will be sold to the new company now being organized in that city, while the Los Angeles branch will be absorbed by the new Los Angeles company. The larger parent company with its increased facilities and larger capital will begin an active sales campaign for the gaining of new business, the old company having been taxed to its utmost to supply orders without solicitation. About 85 per cent of the company's pumps are driven by motors mounted on the same base as the pump. The company has been awarded gold medals on both its deep-well and triplex pumps at the Panama-Pacific Exposition. Gold medals were also received for these pumps at the San Diego Exposition.

Beardsley "Electric" Makes 1500 Miles in Fourteen Days.—Over 1500 miles in fourteen days is the record of the women drivers of an electric vehicle in the recent endurance test held by the Beardsley Electric Company of Los Angeles, Cal. Mrs. Volney Beardsley, wife of the president of the Beardsley company, volunteered to drive the car for the first ten days, different women representing the press and acting as observers. During the last four days the car was driven by owners of Beardsley electric vehicles. On the tenth day, when Mrs. Beardsley believed the test was coming to an end, she decided to make the longest record of the ten days and registered 117 miles. In each case the day's run was made on a single charge of the batteries. The last four days increased the average to 107.5 miles per day, or a total of 1505.6 miles covered in fourteen days. The runs were made over all kinds of California roads in covering the different routes, the greater part of which were country runs over hilly ground. Each night the car came into the garage under its own power.

The New-Process Gear Corporation, Syracuse, N. Y., it is announced, has completed arrangements for the purchase of the Monarch typewriter company's plant at Syracuse, N. Y., about Oct. 1. The buildings of the Monarch plant cover two acres and the surrounding land, which adjoins the property of the New Process Gear Corporation, includes an additional three acres. The main building of the typewriter plant is five stories high, 480 ft. long and 350 ft. wide, being of brick and slow-burning mill construction. After alterations and the strengthening of the floors of the building to a carrying capacity of 300 lb. and 350 lb. per square foot, the New Process Gear Corporation will utilize the building as its job-gear department, and the present plant will be devoted exclusively to the manufacture of automobile differentials. It is the intention of the company to have more than 1000 employees at work before spring, by which time the newly acquired plant will be occupied. The New Process Gear Corporation was incorporated in 1912 as the successor to the New Process Rawhide Company, which was originally organized in 1888.

NEW YORK METAL MARKET PRICES

	Aug. 17 Selling Prices Bid	Asked	Aug. 24 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	67 2 6		67 5 0	
Prime Lake	16.75	to 17.00	16.12½	to 16.37½
Electrolytic	16.50	to 16.62½	15.87½	to 16.12½
Casting	15.87½	to 16.62½	15.50	to 15.75
Copper wire base	18.00†		19.00†	
Lead	4.50		4.50	
Nickel	50.00	to 52.00†	50.00	to 52.00†
Sheet zinc, f.o.b. smelter	17.00†		21.00†	
Spelter, spot	11.75	to 12.25†	14.25	to 14.75†
Tin, straits	34.37½		33.75	
Aluminum, 98 to 99 per cent	33.00	to 35.00	32.00	to 34.00

*OLD METALS

Heavy copper and wire	15.75	15.25
Brass, heavy	10.50	10.25
Brass, light	9.00	8.50
Lead, heavy	4.12½	4.12½
Zinc, scrap	9.50	9.50

*COPPER EXPORTS

Total tons to Aug. 24 13,112

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Pepin Electric Company of Pepin, Wis., has been organized with a capital stock of $5,000 by C. J. Thies, O. E. Jackson and C. J. Johnson.

The Highmore Electric Light & Power Company of Highmore, S. D., has been incorporated with a capital stock of $25,000 by C. V. Armstrong and others.

The McBee Electric Company of McBee, S. C., has been incorporated with a capital stock of $10,000. The officers are: W. L. McCoy, president, and J. D. Sexton, secretary and treasurer.

The Oquossoc Light & Power Company of Rangeley, Me., has been incorporated with a capital stock of $50,000 to supply electricity in the town of Rangeley and neighboring plantations. The officers are: F. B. Colby, president; W. D. Quimby, treasurer, and H. C. Riddle, clerk.

The Southwestern Ice & Power Company of Portland, Me., has been incorporated with a capital stock of $10,000 for the purpose of engaging in a general lighting and power business. The officers are: John H. Pierce, president; Frank H. Purington, treasurer, and David W. Snow, clerk.

The North Glidden Electric Company of North Glidden has been incorporated with a capital stock of $5,000 for the purpose of supplying electricity in the township of North Glidden. The officers are: J. G. Merritt, president; J. J. Sylvester, vice-president; C. C. Briggs, secretary, and F. P. Briggs, treasurer.

The Mission Ice, Light & Water Company of Mission, Tex., has been incorporated for the purpose of installing an electric-light and power plant and ice factory in Mission. Machinery for the proposed plant, it is understood, has been ordered. The officers are: J. A. Sadler, president and manager; M. J. McGurgan, vice-president, and T. L. Langham, secretary and treasurer.

New Industrial Companies

The Prince Electrical Equipment Company of Enid, Okla., has been chartered with a capital stock of $3,000 by C. C. Wilcox, J. Stuart Trimble and C. C. McVay, all of Enid.

The Irving S. Van Loan Corporation of New York, N. Y., has been organized with a capital stock of $5,000 by Irving S. Van Loan, John B. Hyatt and William Phipps. The company proposes to deal in electrical machinery.

The Electric Rod Mill of Rome, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of manufacturing insulated wire, etc. The incorporators are Herbert T. Dyett, Frank M. Potter, Jr., and Clarence R. Keeney.

The Lee Electric Radiator Company of Chicago, Ill., has been incorporated with a capital stock of $50,000 by Ernest E. Lee, Norman J. Fellows and Pierre G. Beach. The company proposes to construct and install electrochemical and commercial products of all kinds.

The Advance Electric Company of Pittsburgh, Pa., has been incorporated by Frank M. Kernan of Pittsburgh, A. J. Wayman and A. B. Wayman, both of Leetonia, Ohio. The company is capitalized at $30,000 and purposes to manufacture and deal in electrical devices of all kinds.

The Ivan T. Johnson Company of New York, N. Y., has been incorporated with a capital stock of $20,000 to do a general electrical illuminating and mechanical-engineering business. The incorporators are H. M. Simon, W. Bigelow and I. T. Johnson, 245 Broadway, New York, N. Y.

The Bass Company of New York, N. Y., has been incorporated with a capital stock of $20,000 by J. Kereks, W. Bass and F. Willman, 409 East Sixty-fourth Street, New York. The company proposes to manufacture and deal in lighting fixtures and to do a general mechanical engineering business.

Trade Publications

Electrical Supplies.—The Electric Supply Company, Memphis, Tenn., has issued Catalog No. 5, illustrating electrical supplies.

Lamp Socket.—A leaflet describing a combination pull-chain and dimming socket has recently been issued by the Wirt Company, Philadelphia, Pa.

Lathe Tools.—An illustrated booklet on rigid-tool holders for use with lathes has been issued by the Rigid Tool Holder Company, Baltimore, Md.

Conduit Fittings.—A catalog illustrating and describing various types of conduit fittings has been issued by the Adapti Manufacturing Company, Cleveland, Ohio.

Railway Meters.—Illustrated Bulletin No. 41, on ampere-hour and watt-hour meters for electric-railway cars, has recently been issued by the Sangamo Electric Company, Springfield, Ill.

Lighting Fixtures.—The Mohrlite Company, New York, N. Y., has issued a bulletin illustrating and describing its semi-indirect lighting fixtures. The company has also published a folder dealing with the use of its fixtures at the Panama-Pacific Exposition.

Push-Button Poster Stamps.—A series of four-color poster stamps has been issued by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., for the purpose of featuring its push-button 660-watt brass-shell and porcelain sockets as well as its porcelain pendent switch.

Phase-Failure and Reversal Protective Device.—The phase-failure and phase-reversal protective device recently developed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., for use with polyphase motors, is described in an illustrated circular which is being mailed by the company.

Electric Meters.—An illustrated catalog describing various types of Kelvin-balance instruments manufactured by Kelvin & James White, Ltd., of Glasgow and London, has recently been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which is the exclusive agent for these instruments in the United States.

Construction News

New England

BOOTHBAY HARBOR, ME.—The Boothbay Harbor El. Lt. & Pwr. Co. has purchased a site on which it will erect a substation this fall. The station will be equipped with a gasoline engine and pressure tank. E. W. Goss is treasurer.

LACONIA, N. H.—The Laconia Gas & El. Lt. Co. is planning to install a new street-lighting system, consisting of 500 lamps of 40 cp. and 30 60-cp. tungsten lamps, to be erected on company's line poles, maintained by overhead wires. No contracts will be awarded as all work will be done by the local company. F. T. Brockington is superintendent.

PORTSMOUTH, N. H.—The Rockingham County Lt. & Pwr. Co. of Portsmouth has recently purchased two Terry turbine feedwater pumps and one Terry turbine and motor exciter. F. A. Belden is superintendent.

WOODSVILLE, N. H.—Two new concrete dams are being built to replace old wooden ones for the Woodsville Aqueduct Corpn., at a cost of about $6,000. The H. P. Cummings Construction Co. has the contract. George E. Mann is engineer.

BETHEL, VT.—Arrangements have been completed for the consolidation of the Gaysville El. Lt. & Pwr. Co. of Bethel and the Hortonia Pwr. Co., with headquarters in Rutland. Plans provide for an expenditure of over $500,000 in rebuilding the plants already in operation and in developing water privileges already secured. A transmission line will be erected from the plant of the Hortonia company at Brandon over Rochester Mountain to Gaysville, a distance of 28 miles. At Gaysville connection will be made with the hydroelectric plant of the Gaysville company. The Hortonia company has recently purchased a water-power privilege in the town of Tinmouth about 13 miles from Rutland capable of developing about 10,000 hp. Contracts have been closed for two waterwheels for the Royalton plant, capable of developing 1000 hp.; a 1000-hp. steam turbine for the Bethel steam plant, to be installed within 60 days; 100 miles of wire has been purchased and work will soon begin on erection of the transmission line. I. M. Frost, formerly manager of the Rutland Ry., Lt. & Pwr. Co., is interested in the company.

READSBORO, VT.—The Deerfield River Pwr. Co., which is controlled by the New England Power Company, has purchased, it is reported, the property of the Metal Edge Box Co., including paper mill and pulp mill and 12,000 acres of land. The Deerfield company intends to develop 4000 hp. at the Readsboro plant and to complete the installation of the electrical machinery this fall. The development of the Deerfield River, which began in 1911, now includes four plants with a total rating of 50,000 hp., and it is planned to develop eventually 125,000 hp.

NORTH ADAMS, MASS.—The Stevens & Thompson Paper Mill Co. is planning to install an electric plant in its mill. Energy to operate the system, it is understood, will be obtained from the Connecticut River Transmission Co. of Worcester.

NORTH ADAMS, MASS.—Arrangements are being made by the Walloomsac Paper Co. for the installation of an electric lighting and power system for its mills. Energy for operating the system will be secured from the Connecticut River Transmission Co. of Worcester, and the electrical apparatus will be installed by the General El. Co.

SOUTHWICK, MASS.—At a special town meeting held recently the citizens voted to authorize the Selectmen to enter into a contract with the Southwick El. Lt. Co. for lighting the streets of the town.

WESTFIELD, MASS.—It is probable that the Municipal Light Commission will request the Selectmen to call a special meeting shortly to vote on an appropriation for the extension of the municipal lines to Southwick, the estimated cost of which will be $3,000.

NEW LONDON, CONN.—Plans have been completed for the Shore Line El. Ry. Co. for the construction of a new power station (45 ft. by 80 ft.), which when completed will more than double its power supply.

Middle Atlantic

BATAVIA, N. Y.—The city of Batavia is considering increasing the output of the municipal electric-light plant to meet the increasing demands for street-lighting service.

BINGHAMTON, N. Y.—The City Council has authorized the sale of bonds to the extent of $148,200 for the construction of a municipal electric-lighting plant.

COHOES, N. Y.—Plans have been submitted for improvements to the Cohoes Hospital, to cost about $28,000, which will include the installation of an electric elevator.

FULTON, N. Y.—The Fulton Lt., Ht. & Pwr. Co. may possibly purchase material for a short transmission line and the usual supply of incandescent lamps and the usual quantities of electrical appliances and supplies. J. J. Jordan is manager.

LETCHWORTH VILLAGE, THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of the Letchworth Village, 55 Wall Street, New York, until Sept. 7 for construction of attendants' home, including general construction, heating, plumbing and drainage and electric work; for laundry building, including construction, heating, plumbing and drainage, electric work and equipment; for service building, including construction, heating, plumbing, drainage and refrigeration, and electric-service connections for cottages A, B, C and D at Letchworth Village. Drawings and specifications may be consulted at Letchworth Village, at the office of Franklin B. Kirkbridge, 55 Wall Street, New York, and at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York. Copies may be obtained at the Department of Architecture, Capitol, Albany.

NEW LEBANON, N. Y.—The Public Service Commission has authorized the Lebanon Valley Ltg. Co. of New Lebanon to exercise the rights under the franchises granted in Canaan and New Lebanon. Work will begin at once on the erection of transmission and distributing lines.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 10 for alterations in heating system in the United States post office in New York. For details see proposal columns.

POUGHKEEPSIE, N. Y.—The Public Service Commission has authorized the Central Hudson Gas Co. of Poughkeepsie to issue $500,000 in bonds for improvements to its system as follows: For improvements to buildings in Poughkeepsie, $58,000; new side track and new machinery at the electric generating station, $175,000, and improvements to distributing system in and about Poughkeepsie, including underground street-lighting circuits and an extension of lines to Pleasant Valley, $20,000. Several thousand dollars will be expended for improvements in the machinery in the Poughkeepsie gas plant. In Newburg the expenditures provided for will include a concrete roof for the electric generating station, to cost $20,000, and several thousand dollars for new cables and machinery. Between $15,000 and $20,000 will be expended in the distribution system at Walden, Cedarcliff, Marlborough, Roseton and Maybrook. The transmission system will be extended from Marlborough to Cedarcliff, at a cost of $4,000; to Stoneco, at $18,000; from Walden to Maybrook, for $12,000, and from Caldwell to Cold Spring, at $6,000.

REMSEN, N. Y.—Arrangements have been made whereby the Utica Gas & El. Co. of Utica will extend its transmission line from Prospect to Remsen to furnish electrical service here.

YONKERS, N. Y.—Ninety-two lamps will be added to the ornamental lighting system on Broadway. The lamps will be of the same type and candle-power as those now in use. An ordinance will also be introduced into the Council authorizing the erection of 12 ornamental lamps in Sherwood Park.

ALLENTOWN, PA.—To provide for increasing business on its line between Allentown and Philadelphia the Lehigh Valley Transit Co. of Allentown is planning to increase the power facilties on this division, at a cost of about $200,000.

CHESTER, PA.—It is said that the Beacon Lt. Co. has closed a contract from the Remington Arms Co. of Eddystone to furnish 12,000 hp. to the new industry. This order will necessitate the enlargement of the lighting plant. The Beacon company has placed an order with the General El. Co., Schenectady, for a 15,000-hp. turbine to be completed within three months.

ERIE, PA.—The capital stock of the Erie County El. Co. has been increased from $500,000 to $1,500,000.

HARRISBURG, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 28 for extension and remodeling (including mechanical equipment and approaches) of the United States post office at Harrisburg. Drawings and specifications may be obtained at the above office or from the custodian of site.

HAZLETON, PA.—The Council has passed an ordinance authorizing the installation of new lamps on several streets. Plans have been submitted for ornamental posts.

CAMDEN, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 14 for installation complete of an electric freight elevator, etc., in the United States post office and custom house at Camden, N. J., in accordance with specifications, copies of which may be obtained at the above office.

MILLVILLE, N. J.—Plans and specifications have been adopted by the City Commission for the installation of an electric-lighting system, and it has passed a resolution to ask for bids for construction of the proposed plant. The Millville El. Lt. Co. now furnishes electrical service.

BALTIMORE, MD.—A plan for a municipally owned and operated belt line railroad connecting with the Pennsylvania, Baltimore & Ohio, Western Maryland and Pennsylvania railroads, with provision for new tunnels through the city and a grand union station at the Fallsway and Biddle Street, has been sent by Mayor Preston to the City Planning Commission. The cost of the proposed roads and tunnels, with 16 100-ton locomotives, electrical equipment and buildings, is estimated at $17,369,000.

FAIRMONT, W. VA.—The Monongahela Valley Trac. Co. and other lines are reported to be contemplating large extensions during the coming year, the construction of a line connecting Fairmont and Clarksburg with New Martinsville being the most important. A line from Weston to Glenville, and another from Clarksburg to Buckhannon, are also contemplated.

MARTINSBURG, W. VA.—Arangements have been completed for the reorganization of the Martinsburg Pwr. Co. under an agreement with Emory L. Coblentz, representing the Hagerstown and Frederick street-railway interests. The name of the company will be changed to the Potomac Lt. & Pwr. Co. and the capital stock placed at $1,000,000. The plants at Dam No. 4 and Dam No. 5 will be enlarged and improved at a cost of about $100,000. The company will supply energy to operate the electric-railway system of the Hagerstown & Frederick Ry. Co.

PIEDMONT, W. VA.—The Davis Coal & Coke Co. is erecting a new power plant at its mines at West Virginia Junction. The new equipment will include a large boiler and engine house, a 15-ton steel tipple and also electric motors for haulage purposes.

FINK, VA.—It is reported that the contract for the electrification of the pumping station of the Norfolk & Western Ry. Co. at Fink, near St. Paul, Va., has been awarded to the Southwestern Engineering Co., Sixth and Shelby Streets, Bristol, Va. This station is one of the most important railway water supplies in the Virginia coal fields, furnishing water for the locomotives of both the Norfolk & Western and the Caroline-Clinchfield & Ohio railways. The energy to drive the pumps will be furnished by the St. Paul Lt. & Pwr. Co. Remote electrical control apparatus is being built by the contractors to permit the operation and control of the pumps at a distance of more than one-half mile.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 17 for construction of a central heating, lighting and power plant at Washington, D. C., advertised Jan. 5, 1915. The proposals must be submitted in accordance with paragraph 9 of the general conditions of specifications. James A. Wetmore is acting supervising architect.

North Central

CLIO, MICH.—This village has signed a contract with the Flint El. Co. of Flint, Mich., for lights. All public buildings and streets will be lighted on a flat rate of 4 cents per kilowatt-hour, while the rate to private consumers will be on a sliding scale of from 3 cents to 10 cents per kilowatt-hour.

DOWAGIAC, MICH.—The Westinghouse El. & Mfg. Co. of Pittsburgh has secured the contract for installing an engine generator and switchboard in the electric-light plant here at a cost of $5,725.

KALAMAZOO, MICH.—At an election to be held Sept. 7 the proposal to issue $350,000 in bonds for extensions to the munici-

pal electric-lighting plant will be submitted to the voters.

MIDLAND, MICH.—The Dow Co., it is reported, has purchased seven acres of land and will erect a power house to furnish electricity for the individual motors which will be used on five wells to be drilled.

AKRON, OHIO.—The contract for construction of a power house for the Falls Rubber Co. of Akron has been awarded to the Akron Storage & Contracting Company, to cost about $5,000.

AKRON, OHIO—The Firestone Tire & Rubber Co. of Akron is installing additional equipment in its power house, including three boilers (two 879-hp. and one 848-hp.), one 10,000-kw. General Electric Curtis horizontal steam turbine, one 100,000-kw., 60-cycle, 2200-volt generator with necessary switchboard equipment, three 2000-kva. transformers, one substation in basement, equipped with three 333 1/3-kva. transformers. Contracts for equipment have been placed. C. A. Myers and R. R. Jones are engineers in charge.

BATAVIA, OHIO.—The village authorities, it is reported, have decided to close down the municipal electric generating plant and will purchase energy for operating the municipal system from the Cincinnati, Georgetown & Portsmouth Trac. Co. of Cincinnati.

CLEVELAND, OHIO—Bids will be received at the office of commissioner of purchases and supplies, Room 500, City Hall, Cleveland, until Sept. 1 for hard-drawn copper busbars for the Municipal Electric Light Department. Specifications may be obtained from the office of the commissioner of light and heat division, 1443 East Third Street.

COLUMBUS, OHIO.—Sealed bids will be received by the Ohio Board of Administration at Oak and Ninth Streets, this city, until 2 p. m., Sept. 10, for installing two 400-hp. water-tube boilers and two 400-hp. stokers at the Ohio Hospital for Epileptics at Gallipolis, Ohio. Specifications are on file at the office of the board and at the hospital. H. S. Riddle is consulting engineer.

COLUMBUS, OHIO.—Sealed bids will be received until 2 o'clock on Sept. 10 by the Ohio Board of Administration, Oak and Ninth Streets, Columbus, for furnishing and installing nine automatic side-feed, self-cleaning stokers for the Institution for the Feeble-Minded, Columbus, Ohio, according to plans and specifications on file with the board. H. S. Riddle, Columbus, Ohio, is consulting engineer for the board.

DAYTON, OHIO.—Bids will be received shortly for the electrical work, including wiring, for the Dayton quarantine hospital. Dr. Light is in charge.

EAST YOUNGSTOWN, OHIO.—The Mahoning & Shenango Ry. & Lt. Co. has recently entered into a contract with the village for an additional lighting system, which will consist of 129 two-lamp standards, the lamps being of the gas-filled tungsten-filament type rated at 250 cp. each. These standards will be used in the business district. Other parts of the village will be lighted with 169 100-cp. lamps. Work on the system has been started, and it is expected to have the 100-cp. lamps in operation by Nov. 1, while the standards are expected to be ready about Dec. 1. E. H. Beil is manager of light and power of the Mahoning & Shenango Ry. & Lt. Co., Youngstown, Ohio.

NORTHFIELD, OHIO—A special election will be held Sept. 20 to submit to the voters the proposal to issue $12,000 in bonds for the installation of a municipal electric-lighting plant in Northfield.

CALHOUN, KY.—The Green River Lt. & Wtr. Co. of Calhoun expects to purchase within the next six months Westinghouse house meters. C. G. Gilmore is manager.

COVINGTON, KY.—The Union Lt., Ht. & Pwr. Co. of Covington expects to erect within the next 30 days 1000 type C Mazda 6.6-amp. lamps, 400 cp., in General Electric Co. form 1 "Novalux" fixtures (500 with refractors and 500 with opal globes), replacing like number of 6.6-amp. arc lamps, supplied from 100-light C.C. transformers. The type C lamps are supplied with compensators. C. W. De Forest is chief electrical engineer.

DANVILLE, KY.—The Danville Lt., Pwr. & Trac. Co. has recently completed the installation of a 16-in. by 14-in. Busch-Sulzer Brothers Diesel oil engine, directly connected to a Westinghouse 200-kva., three-phase, 2300-volt generator, and has changed its system from two-phase to three-phase. George A. Irvine is manager.

HAZARD, KY.—The Kentucky River Pwr. Co., recently organized, is planning to build an electric plant to develop about 5000 hp. for transmission throughout the coal-mining district, at a cost of about $300,000. The plans provide for a 15-mile transmission system, costing about $25,000. R. L. Cornell of Hazard is manager and engineer.

LEXINGTON, KY.—Within the next four months the Lexington Utilities Co. expects to erect about 16 miles of 33,000-volt transmission line for a tie line with necessary switching apparatus; also to purchase the usual supply of material for distribution and lighting systems and electrical appliances and supplies. J. P. Pope is electrical engineer.

PADUCAH, KY.—The municipal electric-light plant has recently installed one Brush arc machine, 125-lamp size, and expects later to install 15 new arc lamps which have already been purchased. W. H. Force is superintendent of the plant.

ELKHART, IND.—Plans and specifications have been prepared by Vaughn, Meyer & Sweet of Milwaukee, Wis., for a lighting system for Main Street, covering ten blocks of business property and two blocks of residence property. The system will be installed by the property owners at an estimated cost of $11,000. The project is now being held up for action by the City Council, which has not yet passed an ordinance overruling the remonstrance filed by four resident property owners on Main Street.

HUNTINGTON, IND.—The light committee of the Commercial Association has made arrangements for the sale of $5,000 in city bonds for the installation of an ornamental street-lighting system.

AURORA, ILL.—The City Council of Aurora is considering the installation of a new police and fire-alarm system to cost approximately $25,642. Plans for the system have been prepared by City Electrician W. E. Barclay.

BELVIDERE, ILL.—Bids will be received until Sept. 10 by the Board of Education for electric wiring, fixtures and telephones for the new high-school building.

LITCHFIELD, ILL.—The United Gas & El. Co. of Litchfield and the Southern Illinois Lt. & Pwr. Co. have entered a joint application before the State Public Utilities Commission for approval of the purchase of the property of the Litchfield company by the Southern Illinois company.

MILFORD, ILL.—The Home Telephone Exchange is laying about 6000 ft. of underground cable, which will be completed in about 30 days.

MILFORD, ILL.—The Central Illinois Utilities Co. expects to make repairs to its high-voltage line between Milford and Watseka, a distance of 12 miles. The Commercial Club is discussing the installation of a white way. E. R. Rush is local manager.

SPRINGFIELD, ILL.—Installation of an ornamental lighting system on Washington Street from First to Tenth Street and on Monroe Street from Spring to Tenth Street is contemplated by business men here. The plan has been brought before the Board of Local Improvements.

WINNEBAGO, ILL.—A franchise has been granted to F. C. Drager to construct and operate an electric-light plant in Winnebago.

WINNETKA, ILL.—Within the next year the municipal electric-light plant expects to purchase an ash conveyor. R. L. Fitzgerald is business manager of the plant.

APPLETON, WIS.—The Wisconsin Trac., Lt., Ht. & Pwr. Co. of Appleton has engaged Woodmansee & Davidson, consulting engineers, First National Bank Building, Chicago, Ill., to prepare plans and supervise the construction of an addition to its steam-power plant.

MERRILL, WIS.—The lighting committee of the Council has submitted a report to the Council recommending the rebuilding of the electric distribution system throughout the city and the installation of a new street-lighting system. The electrical service is supplied by the Merrill Ry. & Ltg. Co.

MANKATO, MINN.—The Consumers' Pwr. Co. of Mankato is contemplating extending its transmission lines to Le Huillier, a suburb of Mankato, to furnish electrical service.

VIRGINIA, MINN.—Bids will be received at the office of the Water and Light Commission, Virginia, until Sept. 6 for furnishing and erecting a mixed-pressure steam turbine, alternate bids being entertained as follows: (1) For furnishing and installing one 1000-kw. mixed-pressure steam turbine and alternator with exciters, condensing equipment and switchboard; (2) for furnishing and installing one 1500-kw. mixed-pressure steam turbine and alternator with exciters, condensing equipment and switchboard. Max Lewis is secretary of commission and C. T. Harding is engineer.

BLOOMFIELD, IOWA—Within the next 12 months the managers of the municipal electric-light plant expect to purchase a small quantity of weatherproof wire, 25 direct-current motors and a small quantity of incandescent lamps. R. C. Bristow is city manager.

BREDA, IOWA—At an election held recently the proposal to issue bonds for the installation of an electric-lighting system in Breda was carried.

GLIDDEN, IOWA—The residents of Glidden Township have organized a company under the name of the North Glidden El. Co. to supply electricity for lamps and motors to the farmers in this vicinity. The company is capitalized at $5,000. As yet the company has not decided whether it will build a plant or erect a transmission line and purchase energy. J. G. Merritt is president.

BUCKLIN, MO.—The Bucklin Lt. Co. expects to purchase within the next few months a few 2200/110 or 220-volt transformers, some meters, cross-arms, pins and insulators. A. J. Coen is proprietor.

CONCEPTION JUNCTION, MO.—A special election will soon be held to submit to the voters the proposal to grant to T. W. Costello of Conception a franchise to construct and operate an electric-light plant here.

PEMBINA, N. D.—Charles E. Fiers of East Grand Forks, who was recently granted a franchise to erect an electric-light plant in Pembina under the name of the Dodge Pwr. Co., is planning to install an electric plant to supply electrical service in Pembina, Emerson, Man., and St. Vincent.

WHITE EARTH, N. D.—Work in connection with the installation of an electric-light plant here, reported Aug. 14, will be in charge of Fred Hermanson of White Earth.

FRANKLIN, NEB.—Bids will be received by Henry Plank, Sr., city clerk, Franklin, until Aug. 31 for one simple high-speed 13-in. by 12-in. automatic engine for direct connection to generator, one steam separator, one 150-hp. open feed-water heater, one 75-kva., three-phase, 60-cycle, 2400-volt engine-type generator, one 7-kw. interpole (belted) exciter, one marble switchboard, equipped with 3-amp. meters, voltmeter receptacle, etc., one triple-pole oil switch for generator and exciter, two 60-in. by 16-ft. tubular boilers, one smokestack (33 in. by 60 ft. with Y-breeching for connecting to stack), two boiler-feed pumps, one complete crude-oil burner equipped for each boiler, with pumps in duplicate. Bids are also desired on an internal-combustion engine ranging from 75 hp. to 125 hp., directly connected to alternating-current generators.

GIBBON, NEB.—Negotiations are under way between the Gibbon El. Lt. Co. and W. J. Scoutt, manager of the Kearney El. & Pwr. Co. of Kearney, for the purchase of the local plant. If the deal is carried through, electricity to operate the local system will probably be transmitted from the power house in Kearney.

NETAWAKA, KAN.—At a recent election the proposal to issue bonds to the amount of $10,000 for the installation of an electric-light plant was defeated.

PLAINVILLE, KAN.—The Plainville Mill & Elevator Co. expects to purchase electrical appliances and supplies to meet current needs. J. V. Burroughs is president.

SOUTH HAVEN, KAN.—Within the next three months the South Haven El. Lt. Co. expects to install a 30-kva. generating unit and to purchase one 25-hp. oil engine, one 30-kw. generator and exciter. J. R. Britton is manager and engineer.

TOPEKA, KAN.—Within the next six months the city of Topeka expects to purchase for the municipal electric-light plant one 500-kva., three-phase, 60-cycle, 2300-volt turbo-generator, with condenser and deep-well pump, and two switchboard panels with equipment previously reported. E. G. Stahl is superintendent.

Southern States

HICKORY, N. C.—Bids will be received by the city of Hickory for the sale of an electric light and power franchise, granting the use of the streets for the purpose of operating electric lighting, power, fuel and heating plants for a period of 30 years. S. C. Cornwell is city manager. The present franchise, which is held by the Southern Pub. Utilities Co., expires in October, 1918.

DAYTONA, FLA.—The Daytona El. Lt. & Pwr. Co., recently incorporated with a capital stock of $50,000, is reported to be contemplating the development of 400 hp. at Daytona and Daytona Beach. Michael Scholtz is president and general manager.

HOWEY, FLA. (not a post office).—The W. J. Howey Land Co., 76 West Monroe Street, Chicago, Ill., is contemplating developing 80,000 acres of Lake County.

which will include the installation of electric-light, ice and water plants.

JACKSONVILLE, FLA.—Bids will be received until Sept. 6 for furnishing 1000 induction recording wattmeters, both single-phase and multi-phase, for 110 volts or 220 volts, 60 cycles, 7200 alternations; 1200-kw. standard transformers, primary voltage 2200, secondary voltage 110/220, in carrying sizes up to 50 kw., inclusive; 2000 kw. single-phase, oil-cooled transformers of subway type, primary voltage 2200, secondary voltage 110/220, either or both, in varying sizes up to 100 kva., inclusive; all on basis of future delivery contract, shipments to be made from time to time as required. For further information address R. N. Ellis, purchasing agent.

LONSDALE, TENN.—The city of Lonsdale is contemplating the installation of an incandescent street-lighting system. Post office address, Lonsdale, Station 7, Knoxville.

ATMORE, ALA.—The W. M. Carney Mill Co. of Atmore expects to erect 5 miles of transmission line to Canoe within the next 12 months. F. Sintes is superintendent.

FAIRHOPE, ALA.—The Town Council is considering a proposition for the installation of an electric-lighting plant. A committee has been appointed to canvass the citizens to ascertain the probable number of consumers.

TROY, ALA.—Within the next two months the electric-light commissioners expect to purchase fifty 250-watt incandescent lamps for the municipal electric-light system. E. T. Freeman is superintendent.

PRENTISS, MISS.—The Electric Lt. & Mfg. Co., successor to the Prentiss Mfg. Co. and the Prentiss El. Lt. Co., expects to purchase within the next three months one 40-hp. oil-burning engine. W. C. Veach is manager.

ARKADELPHIA, ARK.—The Arkansas Lt. & Pwr. Co. has recently purchased the Crystal Ice Co. of Paragould, the Mariana (Ark.) El. Co. and the city water plant. The Arkansas company is planning to erect a power house at Newport, Ark., within the next four months. H. C. Couch is president.

ATKINS, ARK.—The Atkins El. Lt. & Pwr. Co. expects to purchase some wiring supplies within the next six months.

BENTONVILLE, ARK.—Within the next 30 days the managers of the municipal electric-light plant expect to erect 3½ miles of transmission line, using No. 6 bare copper wire. George A. Johnson is superintendent.

CORNING, ARK.—George A. Booser, owner of the local electric-light plant, it is reported, is contemplating changing the system of the plant from direct to alternating current and extending transmission lines to Success and Datto.

GREEN FOREST, ARK.—It is reported that the Green Forest Mill & Elevator Co. has absorbed the Green Forest Lt. & Pwr. Co. The town will now enjoy 24-hour service.

HELENA, ARK.—The Helena Ornamental & Pressed Brick Co. is contemplating the purchase of electric elevators (two, six or eight-passenger), for three-story buildings.

LITTLE ROCK, ARK.—The city of Little Rock, it is reported, is contemplating the purchase of 200 new street lamps, at a cost of about $20,000.

NEW ORLEANS, LA.—The New Orleans Ry. & Lt. Co., which was given until Aug. 11 to accede to the demands of the city for lower rates for lighting, has refused to make concessions asked. The City Commission has decided to go ahead with plans for construction of a municipal electric plant and has invited F. W. Ballard, commissioner and chief engineer of the Cleveland (Ohio) municipal plant, to supervise the work. The cost of the proposed plant is estimated at $6,000,000.

KUSA, OKLA. (P. O. Henryetta).—Plans are being considered, it is reported, by the Kusa Townsite & Improvement Co. for the construction of an electric-light plant.

WIRT, OKLA.—Arrangements are being made by W. E. Gupton to organize a company for the purpose of installing an electric light and power plant in Wirt. It is proposed to supply electricity to the large oil companies in this district.

CORPUS CHRISTI, TEX.—By referendum vote the people of this city have granted J. H. Caswell of San Diego, Cal., and associates, a 30-year franchise for a street-railway system which they will construct here. The proposed system will connect with the interurban railway lines that the same interests plan to build.

DUBLIN, TEX.—The Dublin El. & Gas Co. will extend its street-lighting system.

LOCKHART, TEX.—It is reported that the local electric light, water-works and ice plant has been purchased by W. B. Tuttle of San Antonio and associates from J. A. Bachman of Austin and J. E. Jones of Lockhart. The plant will be improved and enlarged. Frank E. Scovill is the new manager.

SKIDMORE, TEX.—The Texas Southern El. Co. of Beeville is contemplating extending its electric transmission line from Beeville to Skidmore. F. C. Greer of Beeville is local manager.

Pacific States

BELLINGHAM, WASH. — The City Council has voted to adopt a new lighting system in the city this fall. The Mayor and City Comptroller have been instructed to enter into contract for furnishing energy with the Whatcom County Ry. & Lt. Co., a subsidiary of the Puget Sound Trac., Lt. & Pwr. Co. of the Stone & Webster interests.

CENTRALIA, WASH.—At a recent meeting of the Lewis County Commissioners the petition of H. G. Fleischhauer of Portland, Ore., for a franchise to construct and maintain power lines over certain county roads in Lewis County, from the town of Vader to the south limits of this city, was denied. As reported Aug. 14, Mr. Fleischhauer has posted a $10,000 bond to supply the city of Centralia with energy for light and power, and he states that although unable to obtain a franchise in Lewis County he will fulfill agreement with the city, and will be ready to furnish energy by Oct. 1. This city and Lewis County are served with electricity by the Oregon-Washington Corporation.

OLYMPIA, WASH.—The Board of County Commissioners of Thurston County, it is said, has granted a franchise to construct, operate and maintain electric power lines in Thurston County to the George Tilden Bond & Brokerage Co., Hoge Building, Seattle. The company plans the erection of a hydroelectric power plant on the Snohomish River in Mason County, extending service throughout southwestern Washington. The proposed lines will run from Aberdeen to Olympia, serving the small cities and farming communities en route.

SOUTH BEND, WASH.—It is reported that the Willapa El. Co. will begin work shortly on the construction of the first unit of a hydroelectric power plant on the South Fork.

STANWOOD, WASH.—The City Council has granted George W. Kunze of Arlington a franchise to supply electricity for lamps and motors in Stanwood for a period of 50 years. Under the terms of the franchise Mr. Kunze is to take over the local electric-light plant, owned by C. A. Query, at $12,250, and to establish a lumber mill here. The proposed mill will be driven by electricity.

ASHLAND, ORE.—The City Council has signed an agreement with the California-Oregon Pwr. Co. whereby that corporation agrees to vacate the local field, provided the municipality purchases its poles, lines and connections. In return, the corporation agrees to sell energy wholesale to the city in any amount agreed upon, and the city of Ashland will distribute to the consumer. This agreement is for a period of 20 years. At an early election voters of the city will be asked to ratify the proposition and to issue bonds in the sum of $25,000 to take over the power company's equipment in the city limits.

BEND, ORE.—Voters of this city recently defeated at a special election the electric franchise sought by Steidl & Tweet in competition with the Bend Water, Lt. & Pwr. Co., it is reported. The franchise was first granted by the City Council in March, by a vote of five to one, but was vetoed by Mayor Miller, later being passed over his veto. Referendum was then invoked, with defeat at the present election. Charles R. Brown of Chicago, president of the Bend Wtr., Lt. & Pwr. Co., stated that as a result of the defeat of the franchise his company now felt its way clear to proceed with extensions and improvements required by the development of the town. It is understood that improvements mentioned will be made at an early date.

BURNS, ORE.—Within the next six months the El. Lt. & Pwr. Co. of Burns expects to purchase a 60-hp. or 120-hp. Diesel engine.

CANYON CITY, ORE.—The Prairie City Lt. & Pwr. Co. of Canyon City is reported to be contemplating enlarging its plant. The company is planning to furnish electricity for dredging operations at John Day.

EUGENE, ORE.—It is reported that bids are being received by the Eugene El. Co. for furnishing one 1500-kw. condensing turbine steam auxiliary plant, to be built at Eugene for the Eugene El. Co.

FRIEND, ORE.—State Engineer John H. Lewis, at Salem, has granted a permit to the Friend Mill & Improvement Co. for the use of the waters of Jordan Creek, for the irrigation of 1000 acres of land lying in the vicinity of Friend, Wasco County, and for the development of 75 hp. for electric lighting and manufacturing purposes. The cost is estimated between $5,000 and $7,500.

HAINES, ORE.—The local flouring mill, owned by M. Moeller of Baker, Ore., is to be equipped at once with new electrical machinery. It is understood machinery has not yet been purchased.

EUREKA, CAL.—The State Railroad Commission has granted the Western Gas & El. Co. permission to issue $266,000 worth of bonds for improvements. Of that sum, it is stated in the report, $12,000 is to be expended in the Eureka division.

LOS ANGELES, CAL.—Surveys and construction work on the Los Angeles Long Valley power project, it is understood, will soon begin. The budget committee of the Council has tentatively agreed to allow about $60,000 in the budget for the coming year for this work. It is proposed to establish eventually three power houses as auxiliary plants in what is known as Long Valley, which is drained by Owens River and where the city owns a large amount of land. While the power plants are not needed at present and will not be for some time, it is claimed that it is necessary to do some work at once in order to preserve the city's rights in the valley.

MERCED, CAL.—It is reported that plans have been adopted by the San Joaquin Lt. & Pwr. Co. for the construction of a $65,000 substation to take care of the increasing business at Merced.

STOCKTON, CAL.—At an election held Aug. 14 in the towns of Manteca, Escalon and Ripon the proposal to form an electric-lighting district was carried.

STOCKTON, CAL.—Petitions are being circulated among the residents of The Oaks for the installation of electroliers throughout the entire section, with the understanding that the city will supply electricity to maintain the lamps.

EMMETT, IDAHO.—The City Council has decided to change the lighting system here from arc lamps to incandescent lamps of from 60 cp. to 100 cp. each. The city plans to place a lamp at practically every street intersection in the city limits, and also to install lamps in the alleys in the business district.

LEWISTON, IDAHO.—The local Commercial Club, Robert S. Erb president, is discussing a proposition to construct a municipal dam and power plant on either the Snake or Clearwater River, for furnishing energy for both lighting and power.

FLAGSTAFF, ARIZ.—The Flagstaff El. Lt. Co. expects to purchase at once about thirty ornamental street-lighting standards. Either the single-lamp or three-lamp cluster standard will be chosen. G. A. Herrington is manager of the plant.

PHOENIX, ARIZ.—At an election to be held Sept. 1 in Election District No. 1 of Maricopa County the proposal to issue $100,000 in bonds for the erection of an electrical power transmission line and the purchase and installation of necessary equipment, including transformers, meters, etc., will be submitted to the voters.

PRESCOTT, ARIZ.—The Arizona Pwr. Co. expects to install within the next six months a 2500-hp. hydroelectric plant with steel-flume penstock and a 6-mile, 45,000-volt transmission line. The material has been purchased and the work commenced. M. V. Watson is manager.

LIBBY, MONT.—It is reported that the Libby Elec. Lt. & Wtr. Co. will make improvements and extensions to the local system and plant in the immediate future. The property is owned by Kirby & Reynolds of Sheridan, Mont.

ROUNDUP, MONT.—Owing to remonstrances which were filed, the City Council has laid on the table indefinitely the proposition of installing a $10,000 ornamental lighting system in this city, reported July 24. The matter may be taken up later.

DEXTER, N. M.—It is reported that the City Council is contemplating the construction of a municipal electric light and power plant.

Canada

CAMPBELLTON, N. B.—The town of Campbelltown expects to purchase some lightning arresters, transformers and meters for the municipal electric-lighting system. H. G. V. Farrer is manager.

SOUTHAMPTON, ONT.—A by-law will shortly be submitted to the ratepayers to authorize the expenditure of $13,000 for the installation of a hydroelectric system.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 17, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,150,007. ELECTRICAL IMPULSE TRANSMITTER; W. Aitken, London, Eng. App. filed March 17, 1915. For automatic and semi-automatic telephone systems.

1,150,009. TELEPHONE SET; W. P. Andrick, Jamaica, N. Y. App. filed Aug. 22, 1914. "Acousticon" for deaf persons.

1,150,010. CENTRIFUGAL SWITCHING DEVICE; S. L. Armstrong, Pittsburgh, Pa. App. filed June 14, 1912. For preventing excessive speed in rotary converters, etc.

1,150,017. VAPOR RECTIFIER; D. C. Davis, Swissvale, Pa. App. filed May 11, 1914. Self-starting construction.

1,150,019. SYSTEM FOR ELECTRICAL DISTRIBUTION; J. B. Dyer and G. A. Johnstone, Anderson, Ind. App. filed Feb. 16, 1912. Starting and lighting system for automobiles.

1,150,021. MOLDING ELECTRODE; G. Favier, Suspension Bridge, N. Y. App. filed April 15, 1914. Uses special paste and method of compressing.

1,150,022. COIL WEDGE; A. B. Field, Pittsburgh, Pa. App. filed Aug. 2, 1913. Made of magnetizable members spaced apart by an insulating member.

1,150,023. SECONDARY OR STORAGE BATTERY; B. Ford, Philadelphia, Pa. App. filed Nov. 29, 1912. Improved terminal connections.

1,150,035. SYSTEM OF CONTROL; H. D. James, Pittsburgh, Pa. App. filed Feb. 3, 1910. Automatic stop for hoists, etc.

1,150,043. DYNAMO-ELECTRIC MACHINE; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 26, 1910. Main and auxiliary windings with special end supports.

1,150,049. LAMINATED STRUCTURE; F. S. Martin, Edgwood Park, Pa. App. filed Feb. 3, 1910. Core laminations held together by retaining strips welded thereto.

1,150,054. ELECTRIC SIGNALING APPARATUS; E. G. Missbach, New York, N. Y. App. filed June 28, 1912. Uses equalizing currents.

1,150,054. TELEPHONE SYSTEM; H. W. Munsell, Indianapolis, Ind. App. filed June 28, 1909. Novel arrangement for applying ringing current.

1,150,066. POCKET FLASHLIGHT; F. M. Rosenfeld, New York, N. Y. App. filed March 10, 1915. Clips for retaining light in pocket serve as a switch.

1,150,067. SUPPORTING STRUCTURE FOR TROLLEY CONDUCTORS; W. Schaake, Pittsburgh, Pa. App. filed Nov. 8, 1911. Flexible support of trolley wire, for high-speed railways.

1,150,081. METHOD OF MAKING ELECTRICAL APPARATUS; S. Trood, Wilkinsburg, Pa. App. filed Jan. 7, 1914. Current maintained in heater coil while material is being cast thereabout and parts allowed to cool at equal rates.

1,150,101. METHOD OF CLEANING ARTICLES; E. L. Couch, Hartford, Conn. App. filed Jan. 9, 1915. By electrolysis.

1,150,110. AUTOMATIC SIGNAL OPERATOR; E. R. Gill, Yonkers, N. Y. App. filed Aug. 4, 1909. High-speed selective telephone signal.

1,150,111. COHERER; E. R. Gill, Yonkers, N. Y. App. filed Feb. 20, 1914. Decohered by turning to cause particles to roll over each other.

1,150,112. PLUG SWITCH; W. S. Hadaway, Jr., East Orange, N. J., and E. E. Rose, Swissvale, Pa. App. filed Feb. 11, 1910. For effecting different circuit connections.

1,150,116. BATTERY-CHARGING SYSTEM; J. O. Heinze, Detroit, Mich. App. filed May 22, 1914. For automobiles.

1,150,150. MACHINE FOR ELECTRICALLY WELDING THE LINKS OF CHAINS, RINGS, OR THE LIKE; M. B. Ryan, Bridgeport, Conn. App. filed Jan. 29, 1914. Cuts off the rough surfaces after the welding operation.

1,150,169. ELECTRIC MOTOR; S. C. Bryant, Chicago, Ill. App. filed Dec. 1, 1914. For swinging a semaphore arm.

1,150,201. PROCESS OF TREATING CAST IRON; J. E. Johnson, Jr., New York, N. Y. App. filed Dec. 8, 1913. Removes oxygen from cast iron.

1,150,204. ELECTRICAL ALARM SYSTEM; A. Julian, Seattle, Wash. App. filed Aug. 17, 1914. Burglar alarm.

1,150,239. COMBINED AUTOMATIC BURGLAR AND FIRE-ALARM SYSTEM AND TELEPHONE SERVICE; E. Asmussen, Brooklyn, N. Y. App. filed Nov. 7, 1914. Uses only a single circuit. (Ninety-one claims.)

1,150,266. TELEPHONE TRANSMITTER; W. Harrison, Brooklyn, N. Y. App. filed Feb. 24, 1908. For wireless telephony.

1,150,267. APPARATUS FOR TRANSMITTING SOUNDS; W. Harrison, Brooklyn, N. Y. App. filed March 16, 1908. Air exposed to direct action of sound waves.

1,150,270. SUPPORT FOR INCANDESCENT-LAMP FILAMENTS; H. W. Jackson, East Orange, N. J. App. filed Jan. 9, 1908. Springs prevent sagging of the filament.

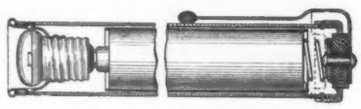
1,150,272. METHOD OF TELEGRAPHIC TRANSMISSION; C. Kinsley, Chicago, Ill. App. filed Nov. 26, 1907. Has indirect acting relays.

1,150,275. SINGLE-PIECE SHELL FOR ELECTRIC-LIGHT SOCKETS; H. W. Lawrence, Denver, Col. App. filed May 12, 1914. Locked on the socket by the operating key.

1,150,307. NORMALLY CLOSED CAB-SIGNAL CIRCUIT; P. J. Simmen, San Francisco, Cal. App. filed July 15, 1907. Constructed particularly to withstand rough usage.

1,150,316. ELECTRICAL RELAY; A. F. Sykes, New Barnet, Eng. App. filed June 3, 1915. Stream of liquid forms part of the circuit.

1,150,326. ELECTROMAGNETIC RECORDING APPARATUS FOR TELEGRAPH CIRCUITS; A. H. Annand, Buenos Aires, Argentina. App. filed Aug. 20, 1914. Includes a three-punch perforator.



1,150,066—Pocket Flashlight

1,150,344. FUSE; A. F. Daum, Pittsburgh, Pa. App. filed May 8, 1912. Plug; refillable construction.

1,150,370. ELECTROLYTIC CELL; H. C. Jenkins, London, Eng. App. filed Nov. 4, 1914. "Bell" type; for production of caustic alkali and chlorine.

1,150,390. ELECTRIC WATER HEATER; R. C. Sage, Arrowrock, Idaho. App. filed April 14, 1914. Electrically heated boiler.

1,150,391. LAMP; A. J. Sanford, Newark, Ohio. App. filed Sept. 16, 1914. Has a hollow glass column.

1,150,395. TELEGRAPHIC TRANSMISSION; C. Schou, Holte, Denmark. App. filed Jan. 12, 1914. Special contacts for reducing sparking.

1,150,413. ILLUMINATING ATTACHMENT FOR TELEPHONES; J. Berry and D. T. Odineal, Lexington, Va. App. filed Feb. 6, 1915. For illuminating telephone booths.

1,150,416. SYSTEM OF DISTRIBUTION; L. E. Bogen and L. C. Nichols, Milwaukee, Wis. App. filed May 13, 1910. Operation of plurality of rotary converters.

1,150,426. ELECTRIC HEATER; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Jan. 28, 1913. Permanent connection of heating unit to the heated member.

1,150,427. ELECTRIC IRON; W. S. Hadaway, Jr., New York, N. Y. App. filed Sept. 5, 1911. Rugged construction of heater.

1,150,428. ELECTRIC IRON; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Jan. 6, 1913. Welds a heater-unit retainer to the base of the iron.

1,150,431. ELECTRIC IRON; A. S. Heineman, Los Angeles, Cal. App. filed July 6, 1914. Has an automatic cut-out.

1,150,434. LAMP SOCKET AND THE LIKE; C. J. Klein, Milwaukee, Wis. App. filed Oct. 28, 1913. Socket locked against rotation in the shell.

1,150,437. MOLDING MACHINE; F. E. Layman, Milwaukee, Wis. App. filed Oct. 2, 1913. For forming attachment plug basis.

1,150,463. IGNITION DEVICE FOR EXPLOSIVE ENGINES; H. R. Stuart, Springfield, Ohio. App. filed Dec. 29, 1913. Increases the spark of a magneto when starting the engine.

1,150,486. BRUSH HOLDER; C. O. Bergstrom, Boston, Mass. App. filed Aug. 12, 1912. Accommodates brushes of different sizes.

1,150,494. SIGNAL SYSTEM; J. P. Buchanan and F. B. Wiegand, Cleveland, Ohio. App. filed May 6, 1910. Operated by passing trains.

1,150,519. MOTOR CABINET; N. H. Holland and N. C. Durand, West Orange, N. J. App. filed Oct. 2, 1912. For phonographs.

1,150,520. MAGNETO-ELECTRIC GENERATOR; N. M. Hopkins, Washington, D. C. App. filed Aug. 1, 1912. For electric tachometer.

1,150,523. ENGINE-STARTER DEVICE; C. F. Kettering, Dayton, Ohio. App. filed June 15, 1911. For automobiles; special coupling means.

1,150,528. SASH HOLDER AND BURGLAR ALARM; C. C. Lott, Hattiesburg, Miss. App. filed Oct. 29, 1913. Holds the window in any desired position.

1,150,530. X-RAY TUBE; R. H. Machlett, New York, N. Y. App. filed Nov. 18, 1914. Novel anode and cathode constructions.

1,150,569. FUSE; W. C. Banks, New York, N. Y. App. filed June 7, 1913. Special grips for fuse strips.

1,150,590. ELECTROLYTIC LIGHTNING ARRESTER; G. Giles, Fribourg, Switzerland. App. filed March 13, 1913. Has conducting members forming a chain.

1,150,652. SYSTEM OF ELECTRICAL DISTRIBUTION; E. F. W. Alexanderson, Schenectady, N. Y. App. filed June 19, 1911. Single-phase alternating current supplies a polyphase load.

1,150,670. TREATMENT OF REFRACTORY METALS; G. Gmür-Zehnder, Arrau, Switzerland. App. filed Jan. 15, 1915. Manufacture of tungsten filament.

1,150,697. INSULATOR; Z. W. Neely and G. A. Lewis, Rayland, Ohio. App. filed Oct. 28, 1914. Two-part insulator with grooves to receive converging wires.

1,150,698. SWITCH; A. E. Newman, Sheguindah, Ontario, Canada. App. filed Nov. 11, 1913. For electrically operated shuttle.

1,150,706. THERMAL SWITCH; M. C. Ryan, Phoenix, N. Y. App. filed March 13, 1914. Light flasher; action is uniform at high or low temperature.

1,150,738. INCANDESCENT ELECTRIC LAMP; J. H. Birch, Gatliff, Ky. App. filed Aug. 8, 1913. Has circular concentric filaments.

1,150,765. TELEGRAPHIC TAPE PERFORATOR; O. and H. Hoenack, Arlington, N. J. App. filed Aug. 15, 1913. Punch-operating mechanism for Delany system.

1,150,786. APPARATUS AND THE METHOD FOR PRODUCING NITRIC ACID; H. D. Hankin, Pittsburgh, Pa. App. filed Sept. 19, 1903. From atmosphere, by electric arc.

1,150,796. SEARCHLIGHT FIREARM; E. S. Ward, Portland, Ore. App. filed Jan. 13, 1915. Light rays projected on point sighted by gun barrel.

1,150,798. SYSTEM OF RAILWAY SIGNALS; E. C. Wood, Somerville, Mass. App. filed April 16, 1909. Operating batteries carried by the locomotives.

1,150,799. METHOD FOR INDICATING A SHIP'S APPROACH AND MEANS THEREFOR; E. C. Wood, Somerville, Mass. App. filed Dec. 11, 1912. Detects approach of hostile ship.

1,150,829. SIGNALING SYSTEM; H. C. Wilson, New York, N. Y., and C. R. B. Claflin, Boston, Mass. App. filed Aug. 27, 1907. For transmitting range, etc., to number of gun stations. (Seventy-six claims.)